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THE BRICKBVILDER

VOLUME XXV SEPTEMBER, 1916 NUMBER 9

Does it Pay to Improve Manufacturing and Industrial Buildings Architecturally?

ILLUSTRATED WITH REPRESENTATIVE MANUFACTURING AND INDUSTRIAL BUILDINGS OF THE MIDDLE WEST.

By GEORGE C. NIMMONS.

THE appeal which this question may make to the individual must depend, first of all, upon his estimation of its importance. In achieving the success which the manufacturing industries of this country have attained, it seems that they have exhausted almost every source which could aid them excepting architecture.

The manufacturers and owners have not generally regarded the architectural profession as one which could help them much in securing practical benefits and advantages in the planning and designing of their buildings, and on the other hand it seems as if the architects generally have not cared to enter this field of work.

As far as the architect is concerned I do not believe that he generally realizes the importance of the factory problem nor appreciates the opportunities which he as architect has for doing big things for one of the most important business interests of this country. This is a commercial and industrial nation first of all, and yet architects generally have not entered this field of work to any considerable extent. The factory problem must certainly appeal to the architect on account of the size and nature of it. There are altogether over six million, seven hundred thousand people engaged in manufacturing in this country, and in addition to these people are their families which average four and a half persons to the worker, making a total of over thirty-four million people, which is just one-third of the entire population of the United States.

View of Tower; Sears, Roebuck & Co. Plant, Chicago, Ill.
Nimmons & Fellows, Architects

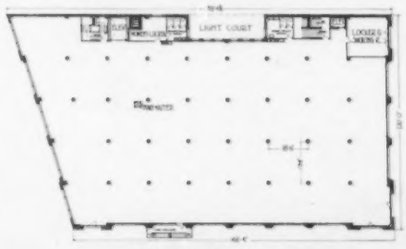
Of course, whatever influences and affects the welfare of the worker also extends down into his home and produces a corresponding effect there, so that we can truly say that the factory problem offers to-day one of the largest and one of the most deserving fields in which the architect can practise.

If it is true that the architect is able, on account of his training and qualifications, to design and plan a factory building so that because of his services it shall be better than it otherwise would have been for the welfare of the employees and for the economic and profitable manufacture of the product, then the architect who enters this field is surely doing something well worth while. It seems, on the other hand, that if architects do not assist with this problem that they are ignoring the spirit of this commercial age, and are also missing one of the greatest opportunities for success offered them in our times.

In spite, however, of the general disinclination of architects and owners to get together for a better solution of this problem, there have been a few architects and owners in recent years who have undertaken the solution of some of these problems together. What they have accomplished is perhaps only the beginning of bigger things to come as the work develops. Yet the changes that have been brought about in these cases and the unexpected improvements that have been made in factory and industrial buildings in some instances have attracted considerable atten-

tion and caused many people to wonder what the real reason and motives behind them were. The practical business man who is not familiar with them wants to know why some of our manufacturers and the heads of some of the big industries of the country have undertaken such movements and reforms. Is it all for philanthropy? Does it affect the profits of the concern? Is there anything to it which would tend to better the quality of the product handled? Does it improve the efficiency of the men and the quality of the work they do? Has it even a bigger and more far-reaching meaning? Can it properly be classed with a movement to benefit humanity? These are big questions and yet the reasons and the motives behind these men who are doing so much to improve factory and industrial buildings and the condition of the employees seem to be just as big and important as the questions asked. It undoubtedly is true that some who have gone in for these reforms have been actuated by purely selfish motives of profit; yet it often happens that the prerequisites and essential conditions for the highest efficiency and success financially nowadays are so intimately connected with these conditions and provision for the welfare of the employees and advantages of a high-class building that one cannot be separated from the other, and the owner who would make the most money is the owner who has adopted these big reform movements.

Rogers & Company Building, Chicago, Ill.
Mundie & Jensen, Architects



First Floor Plan

It does not seem fair, however, to attribute the majority of the credit for modern industrial reforms to selfishness, because the fine things that are being done for many big plants go way beyond the point required for maximum profits. Undoubtedly the cause of humanity still has many true friends and adherents, and not a few of these can be found among the heads of big industrial plants.

On the other hand modern competition, aided by science and art, in manufacturing has set a pace so rapid and has necessarily intensified and speeded up the activities of the industries to such a degree that the conditions under which employees now work are far more severe and trying than they ever were before, and in addition to this the manufacturer is obliged on account of this competition and the shortening of working hours to secure the greatest efficiency in his plant, together with the most economic methods of operation in order to succeed in his business, so that now we have a situation where the employer is eager to take advantage of every agency that can assist him, and where the employee is in need more than ever of better conditions under which to work.

A more auspicious time for architects generally to enter this field could not have been devised, and on account of the inviting opportunities for success open to them they cannot fail to achieve results well worth the doing.

Coming now to the discussion of what an architect can do for the improvement of factory and industrial buildings, there appears to be more than any one writer could suggest or describe. It is the object, however, of this article to take up only those things which most obviously fall within the scope of an architect's work and to illustrate in a general way some of the results obtained.

In the study of a factory or industrial building the first thing an architect would naturally undertake to do would be to beautify the building or at least make it interesting. The question would at once arise as to the added cost. But before we come to that there is one other thing that the trained architect would do that stands first in the consideration of the problem. He would study the requirements from all sides of the particular industry in hand. He would learn at least in a general way the essential processes and methods of handling the material and the product of the plant. He would then make a comprehensive plan that would provide for the future growth and would also provide for the ideal manufacturing or handling of the product, so that there would be no waste either in labor or the travel of material. The lighting, the ventilation, the sanitation, the safety, comfort, and convenience of employees, the insurance and the surroundings of the plant are also important features which he would take up in turn and adequately provide for. With these problems well in hand the designer, then, is in a position to mould them around in his plan and work out his elevations so as best to secure that other quality of the problem,—the beauty of the building and its surroundings.

It is commonly supposed by the laity that whenever an architect undertakes to make a manufacturing plant attractive or beautiful in design, that the cost for constructing it is immediately increased materially and indeed often beyond the means available for such structures. The fact that this is absolutely untrue can perhaps best be shown by a few statements and the presentation of concrete illustrations of some buildings where costs are given.

In the first place, attention should be called to the fact that there are a great many essential elements in the construction of every building, such as piers, lintels, sills, openings, copings, gables, etc., which, without adding any unnecessary expense to the cost of the building, may be grouped, moulded, spaced, and so designed that they will add great interest to the exterior. Often the skilful

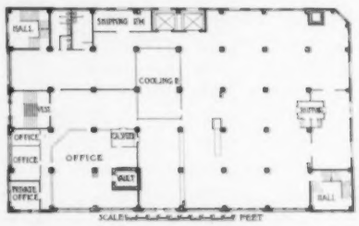
designer can take the same elements of construction present in a very severe and unattractive façade and by transposing them around and moulding them into shape make of it a very beautiful building. Beauty in buildings, of course, is not attained by plastering on expensive ornamentation, and the architect knows how to secure it without resorting to the addition of unnecessary and expensive materials.

There are some architects who are very clever in the use of brickwork whereby most attractive designs and patterns are secured by placing bricks in and out of the common plane of the building. These masses of brickwork make projections and depressions which with their shadows produce ornaments, or they may emphasize or express in a most interesting manner the construction of the building or its use. Then again there is the opportunity in brick-pier construction of building the offsets of the piers outside of the building instead of inside as is the general custom. By placing the offsets outside as the pier goes up and grows thinner, the effect of a buttress construction is made which in itself is a most fertile means of adornment, as is so well exemplified in the old cathedrals. These methods of securing architectural design employ absolutely the same materials as would be used in the plainest of buildings and therefore add no additional expense as far as the materials are concerned.

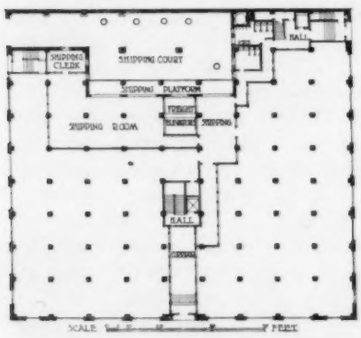
Then comes the question of color. This thing which is so sensitive and sometimes so evasive to conquer is a thing so powerful in its effect that the building may be absolutely hideous and unattractive, or it may appear perfectly suited to its surroundings and functions, and at the same time most attractive and beautiful, just in proportion as the question of color is properly and successfully handled. Color, as a rule, in these days of modern building materials is not a thing of extra expense, but a thing of good taste and proper selection. Brick, terra cotta, and other burned clay products can be secured in almost any tint of the rainbow at no greater cost for one color than another. The architectural palette from which one may choose without regard to cost is almost as large as that of the painter. The architect may, if he chooses, to suit some particular site make the whole building in monotone and match to one color the brickwork, terra cotta, and all visible materials, or he may undertake the more splendid effect of different colors and secure combinations as bright and gay as a flower bed. Bright colors properly combined are often a good antidote for coal soot and dismal surroundings. Different shades of color in the brick are a most effective means of working out patterns and designs in a wall that often make it most interesting. Two of the most difficult problems in color selection are the widely varying carrying qualities of different colors and the effect of dirt on them after they are in the building for a while. Some colors in certain finishes carry a long distance, while others rapidly grow dim and change in character as the distance from them is increased. It often happens that after a most careful selection of colors from samples the effect is disappointing in the building because certain colors high up or far away from the common observation point do not carry, and lose their brilliancy and effect, thereby failing to produce the combination expected. It pays, therefore, to experiment and study the colors at long range, similar in distance to the distance from which they will be seen in the building.

Perhaps the most frequent disappointment or failure to secure complete success in color selec-

National Candy Co. Building, Minneapolis, Minn.
Hewitt & Brown, Architects



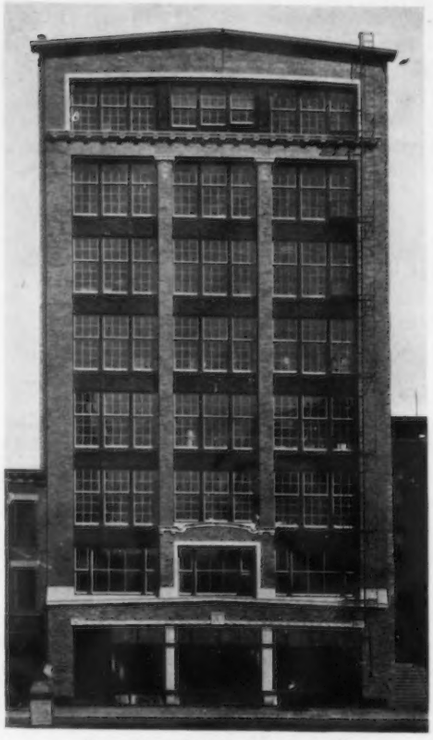
First Floor Plan



First Floor Plan

Western Newspaper Union Building, Chicago, Ill.
J. C. Llewellyn, Architect

tion is that which results from timidity in handling brilliant colors. The more good taste a designer has, the more he seems to fear the possibility of some garish combination resulting from color selection, and rather than take the chance of this he frequently selects with ultra-conservatism and chooses those effects much lower in the color scale than the situation demands, and the result is consequently disappointing, particularly in the city atmosphere after the first covering of coal soot has been deposited. The writer has often heard architects admit after their buildings had been completed, and on which the color had not come up to their expectations, that they had really been afraid to go in for the strength of color which the problems required. So long as the color scheme has to do with the combination of complimentary colors in their various shades and tints, it is usually the case that the most beautiful effect is obtained through a bold handling of strong and brilliant colors that will have carrying power, and that the dirt in the city atmosphere cannot screen from view after a few years.



Henneberry Building, Chicago, Ill.
Howard Shaw, Architect

Then again there are many features of factory buildings which provide opportunities for the designer to utilize architecturally without excessive cost. The most common perhaps of these nowadays is the requirement of the insurance companies for a sprinkler tank for fire protection. The insurance requirements for the size of the tank and its height above the roof of the building are nearly always such as will make a beautifully proportioned tower in case the tank is enclosed with walls and roofed over. To construct enclosing walls and roof around such a tank adds comparatively little to the cost of the essential supports of such a tank, for the reason that such walls can easily be carried on brackets or shelving attached to the tank supports, and the walls themselves need not be of heavy or expensive construction. Such a tower, as a rule, has the effect of producing a dominant feature in the architecture of a plant and may be of great beauty and attractiveness in contrast to the unsightly, ugly water tank which often kills the architectural design. There are practical advantages for such towers that are of considerable importance. The tank itself is protected from the weather and the consequent freezing of the water, and deterioration of the materials and supports of the tank are thereby avoided. It also provides a place for other water tanks such as are often connected with the plumbing of a building, and the additional area of several rooms in the shaft of the tower below the tank frequently furnishes some very useful, quiet, and well lighted office space.

The necessity of constructing skylights, monitors, and ventilators on the roof, again sometimes provides a suggestion for the architectural design in the elevation of the building that may be moulded into gables, or other forms following the sections of the skylights, which are correct expressions of the structure and function of the building.

These are only some of the leading features constantly occurring in the problems of manufacturing and industrial plants which give to the architect his opportunity for designing façades of great interest and attractiveness.

The architect and builder can readily appreciate how the constructive elements of a building can be handled at small extra expense so as to make the building attractive and beautiful; but the owner who is unfamiliar with these things usually desires something more convincing than such statements. I do not know that any architect has ever made public the actual cost in dollars and cents of the results of his efforts to make a building attractive in design; but in order to try and throw some light on this question I have taken a building which I consider is fairly typical of factory buildings in its requirements and used it as an example to illustrate the extra cost involved.

Jelke Building, Chicago, Ill.
Huehl & Schmidt, Architects

For the purpose of

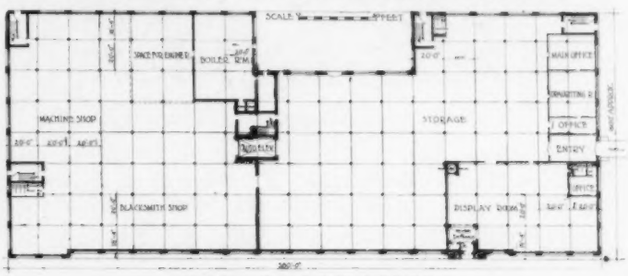
making a comparison an illustration of the C. P. Kimball Factory Building is presented, and in addition a design for the same building in which every single thing which might add to its attractiveness has been taken away. This design shows it with its ugly sprinkler tank on stilts above the roof and all the characteristic barren boldness of the "strictly utilitarian factory design." The contractors, Selden, Breck & Co., who built the building made an estimate of the cost to build the same building according to the "utilitarian design" and the results are as follows:

The Kimball Building cost approximately $326,000. The same building, as estimated by the contractor, would have cost, if built at the same time according to the "utilitarian design," $311,043, so that the total saving which could have been made by adopting the latter design would have been $14,957. In other words, this relatively small additional expense saved this building from being an ugly eye-sore in the landscape.

In the experience of the writer there is not one owner in a hundred who would expect this difference in cost between these two designs to be anywhere near the low amount it is. They would more likely assume that such a striking difference in the two designs would cost from $50,000 to $75,000.

Take, for instance, another example: the Administration Building of Sears, Roebuck & Company illustrated on page 222. Almost the entire ornamentation of this building is secured by the use of terra cotta. The total cost of the terra cotta or the amount of the terra cotta sub-contract was $34,000 and the cost of the building over $650,000. The greater portion of this terra cotta consists of window sills, lintels, copings, and base courses which are essential elements in the construction of the building, and could not be omitted in any design for this building, no matter how plain and unattractive the design might be — not even if we succeeded in getting it into the strictly "utilitarian design" class. These elements are a necessary part of the enclosing walls of the building. The ornamentation might be taken off the face of the lintels, but this ornament is made from moulds and its cost

"Utilitarian Design" for C. P. Kimball Building, Chicago, Ill.



First Floor Plan, C. P. Kimball Building

C. P. Kimball Manufacturing Building, Chicago, Ill.
George C. Nimmons, Architect

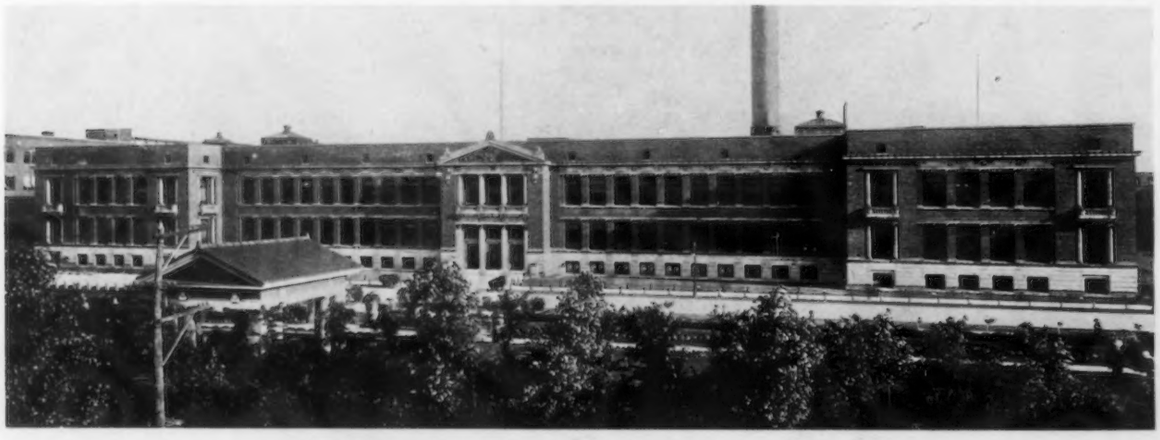
is very nominal. Other material, such as cut stone, might be used, but as a rule the cost of cut stone sills, etc., is about the same as terra cotta and besides this cut stone is more difficult to support than terra cotta lintels and does not make as good or as waterproof a coping as terra cotta, so that the majority of this terra cotta would be necessary for the enclosing walls of the building. If, then, we were to make this change in the building, all ornamentation would be removed and there would be nothing left but a plain, severe box of a building without anything to relieve its severity. The total cost, therefore, of all that is ornamental or interesting is only $12,000, or about 1.8 per cent of the cost of the entire building.

Other buildings might readily be offered for further proof of the proposition under discussion, as many buildings which are most attractive in design are dependent almost entirely, as this one is, on the terra cotta and brickwork as the material and means through which the attractiveness of the design is secured. In every one of these buildings in mind the cost of the ornamental terra cotta which is not essential to their construction is relatively very small indeed when compared with the cost of the building.

Among the ornamental features of a building previously referred to was the enclosing of the sprinkler tank to form a tower in connection with the principal façade of the building. It was stated that in order to secure low insurance rates the insurance authorities usually require a large sprinkler tank above the roof. It was also pointed out that the tank with its heavy load of water, anywhere from thirty thousand to one hundred and sixty thousand gallons, required very substantial supporting columns and foundations, and that the additional strength in these supports necessary to carry enclosing walls was relatively small. This can readily be appreciated when the weight of the walls enclosing the tower is compared with the great weight of the water. As an example of such a tower the Reid, Murdoch & Company tower is shown. This tower is 38 feet square and 200 feet high. The water tank is steel and contains sixty thousand gallons of water. The estimated cost of all work to enclose the tank and form a tower above the roof was $16,000, which is only about 1½ per cent of the cost of the building. The tower is the dominating feature of the principal façade and there is no one thing in connection with the building that could have been utilized as economically as this for similarly emphasizing the design and giving character to the building.

National Cash Register Company Plant, Dayton, Ohio
F. M. Andrews, Architect

The tower in the Kimball Building before referred to is 28 feet square and 108 feet high and contains a water tank of thirty thousand gallons. The cost to enclose this tower was $6,488. The water tank shown above the roof in the utilitarian design of this building shows more forcibly than words could describe how ugly such a tank is and how much it would detract from the appearance of any building. Another feature of this tower is that it has a belfry in which chimes of four bronze bells play a pleasant tune to mark the beginning and end of the working hours instead of the usual steam whistle and its jarring note. In connection with both towers above de-



Administration Building, Sears, Roebuck & Company Plant, Chicago, Ill.
Nimmons & Fellows, Architects

scribed, the additional floor space added by these towers should be taken into account when considering the additional cost.

In order to get some further testimony on this matter, a letter was written to Mr. Albert Kahn of Detroit, Mich., who has done so much in improving the architecture of the buildings for the automobile industry, and an expression of his views was asked. His letter in reply is as follows:

" Replying to your note of April 25th, I find no difficulty in convincing an owner that it pays to build factory buildings attractively, rather than without consideration of appearance. The difference in cost should not exceed 5 per cent of the total outlay. This means $5,000 on a $100,000 structure. The interest on $5,000 at 6 per cent is $300 per year — a sum any one would gladly pay for merely the pleasure of owning a well designed building, to say nothing of the advertising value of such or the increased efficiency of the employees because of such.

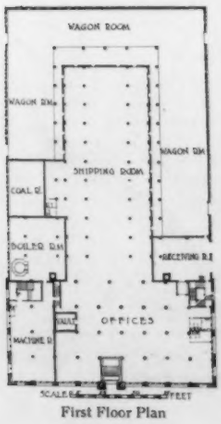
" I really feel that the matter of uninteresting, unarchitectural factory buildings is more the fault of the profession than the owner. With many architects even to-day — though less so than formerly — the factory building is something to be delegated to the office boy and is not considered worthy of their best. That the number of these practitioners is growing less is proven by the better work being done to-day.

" The principal thing now to be guarded against is the sacrifice of practical requirements in an effort to gain architectural results. The very root of good architecture is that it serve its function, and this applies to factory design as well as the more monumental building. Large areas of glass are necessary for proper work inside. To make a virtue of this requirement is the problem. Nor is it necessary for making the factory building attractive to lavish costly ornamentation, in fact, it often suffers in just about the proportion that such is used. Good mass, proper disposition of structural members, interesting skyline, and a judicious use in point of color and texture of the materials employed are the important factors, and these do not involve excessive expenditure. Therefore, there need be little need for convincing the owner that good-looking factory buildings pay. It is distinctly up to the architect."

Albaugh Building, Chicago, Ill.
Howard Shaw, Architect

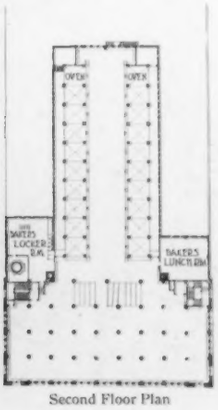
If, then, the opportunities are many, and at the same time not necessarily expensive for the architect to improve the appearance of these buildings, why should they not all be attractive or at least interesting? It would seem unnecessary to argue that beauty and attractiveness in buildings is desirable, as that is the distinguishing mark of advanced civilization; but the hard headed business man likes something less general and more practical as a basis for his indorsement.

The beautiful and attractive factory building has some very strong, practical reasons for its existence. In the first place it is a good advertisement. There is no one feature of a business concern, outside of the merit of its goods, which is as generally used to create a favorable impression among its customers as a picture of its building, provided it is substantial and attractive looking. Experience has shown that the customer expects a reliable and trustworthy firm to succeed well enough to have the means to build a suitable building, and if they have the means to build and do not, then they lack confidence in their own future success. Therefore, one of the essential elements of success is at least a substantial, first-class, attractive building. If it is not attractive it is no good

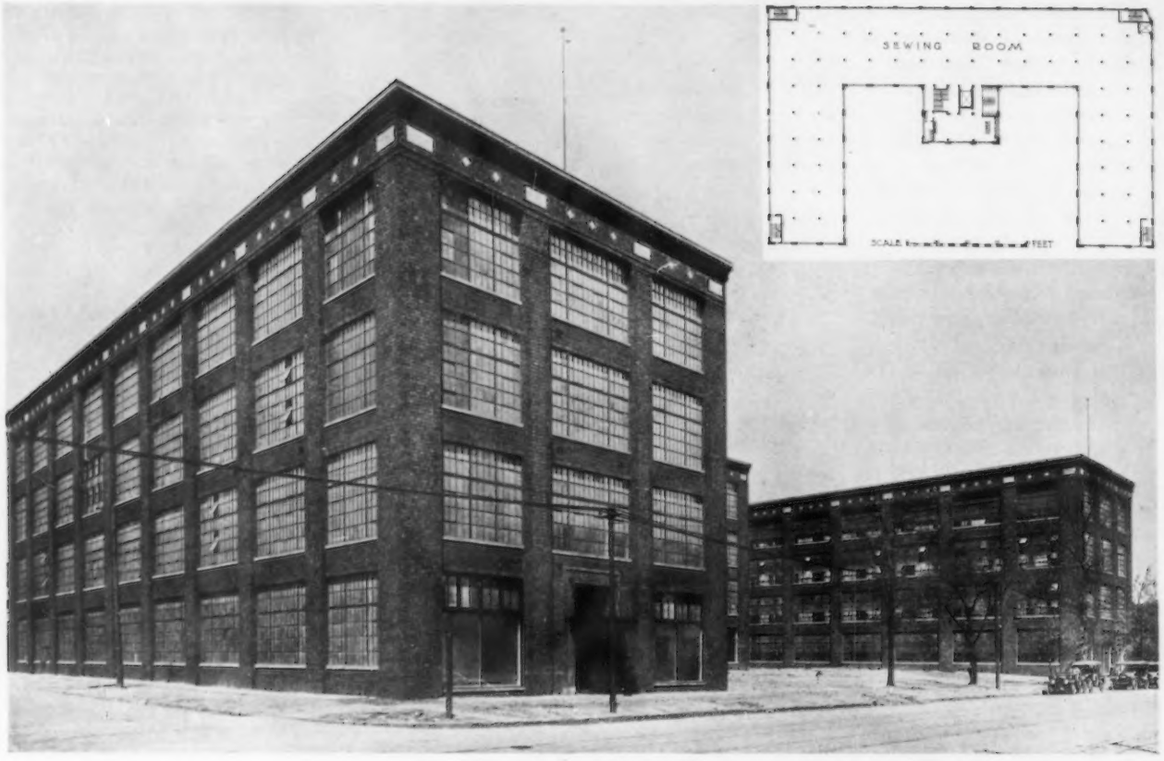


First Floor Plan

Schulze Baking Company Building, Chicago, Ill.
John Ahlschlager & Son, Architects

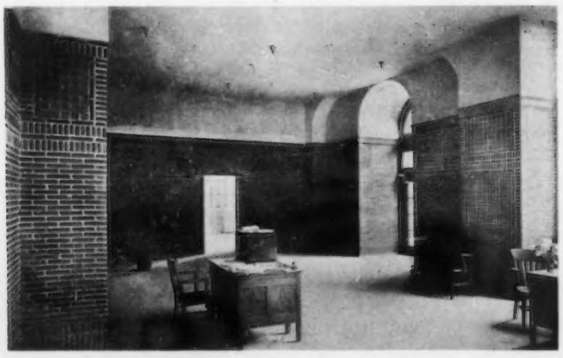


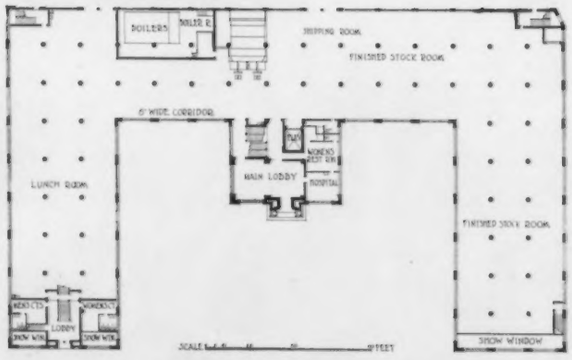
Second Floor Plan



GENERAL VIEW OF EXTERIOR

VIEW OF ENTRANCE PAVILION





FIRST FLOOR PLAN AND VIEW OF LOBBY

MANUFACTURING BUILDING OF RICHMAN BROS., CLEVELAND, O.

CHRISTIAN, SCHWARZENBERG & GAEDE, ARCHITECTS

for advertising and, on the other hand, the more attractive or beautiful it is, the more favorable attention it will attract and the more good it will do as an advertisement. It is hard to estimate the great value which a fine building is to the business of some firms. This advertising value must vary, of course, with the nature of the business; but as a rule there is an inseparable connection in the mind of the average customer between a fine building and first-class goods and a bad building and poor goods. Therefore if it pays to advertise, it pays to advertise through the medium of an attractive building, and the relatively small amount of money which an attractive building would cost over and above the cost of an ugly one can be very properly regarded as an advertising investment which will ensure ample returns.

Administration Building, Eastman, Gardiner & Co., Laurel, Miss.
Frank Arnold Colby, Architect

A building that is beautiful, particularly if it is located in attractive surroundings, has a very beneficial effect on the employees and a wholesome effect on the owner as well. A man cannot help but be influenced by the character of a building and its surroundings which he has to go to and work in every work day of the year. Every bit of enjoyment or satisfaction which a person experiences is just that much uplift and assistance for performing the duties of the day; and if the building and its surroundings where a man works are such as to give pleasure and contentment on account of their beauty, then that building and its site are silently and perhaps unconsciously exerting a beneficial influence on all those around them.

First Floor Plan

The feeling of loyalty among workers is also influenced by the character of the surroundings. It is much easier for a worker, if other things are equal, to pin his allegiance to a place that is beautiful and attractive than to one that is ugly and for which he could not have any feeling of pride. The *esprit de corps* of a body of workmen has a strong influence on the character of their work, therefore the pride which they may have in their workshop and the allegiance to their plant is a very important matter.

The benefit which every beautiful building is to a community and to a city has long been recognized, and it is always through the united efforts of the citizens in improving their buildings that a community or a city is made to grow and prosper. Every beautiful factory building benefits the owner by reason of the civic pride it fosters and the prosperity which it helps to bring to the community and the city in which it is located.

The improving and perfecting of factory and industrial buildings architecturally have as much to do with the conditions surrounding the workmen as with the beautifying of the buildings. The principal objects to be attained for the benefit of the employees are provisions for their safety, health, convenience, contentment, and the most favorable conditions for executing their work. A great deal has been done by many states and cities in requiring certain stairways and fire-escapes for exits in case of fire or panic. There is also the requirement of fire walls to act as a cut-off against the spread of fire into the different parts of the building. Yet in most cases the laws governing these things have been the result of some awful catastrophe where the loss of life has been sufficient to stir up public sentiment requiring action on the part of the public officials. Then these officials, usually the aldermen of a city, frame up some law to prevent the recurrence of the particular accident which happened in their locality. This law may not be comprehensive and usually is not sufficient to provide completely for the safety of the employees under all reasonable circumstances. The result is that laws vary in different localities, and there is hardly any locality which provides against all of the various horrible things that have occurred from time to time in different places. The benefit of the experience of the various localities might be gathered together and standardized for the whole country. At any rate, the architect can and will very likely provide for safe exits whether the law in the locality compels it or not. There is one absolutely vital requirement for the safety of workers in a wooden floored building of any particular height, and that is that there should always be not only fire-escapes, but real, ample, fireproof stairways enclosed in substantial fireproof walls.

In the fireproof building the architect can see to it that the fireproofing is really sufficient in case of fire to actually take care of the supporting and the load-carrying parts of the building. The prevention of accidents by machinery can be provided for in connection with the mechanical engineering.

The health of the employees is a matter for which the architect can do much. The three things in every building which are, of course, essential but which are not by any means always provided are good air, sanitary provisions everywhere, and proper plumbing. The various apparatus available for ventilation are so perfected that

a good, clean atmosphere full of oxygen, at any desired temperature and of any required humidity, can be provided for almost any building. Sanitary conditions can usually be secured by the use of proper materials, and designing and arranging the parts of the building involved, and as far as plumbing goes America leads the world in the perfection and excellence of its fixtures.

Jewel Tea Company Building, Chicago, Ill.
Nimmons & Fellows, Architects

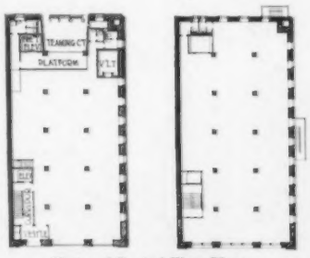
Another most valuable feature for the workers is the hospital in connection with the factory, whether it be a complete one in charge of a physician and nurses or whether it consists only of a room with a cot and a cabinet of medicines. At any rate it is a most humane institution and is often the means of saving lives and relieving much suffering.

To provide for the convenience of employees in a factory is just as much an architectural problem as providing for the convenience of members of a family in a house. There is nothing that frets workers so much as the failure to have things conveniently arranged, particularly when it puts them to extra trouble and annoyance. The needless climbing of stairs, or the unnecessary traveling of distances in the performance of their duties, and the failure to have things arranged for the convenient, economic handling of the product are frequently hindrances which prevent the operation of a plant to the best advantage. The matter of convenient arrangement in a building is one of the important things an architect is trained to do. No one can possibly eliminate defects of this kind in a plan more readily than an architect because it is part of his business to do so.

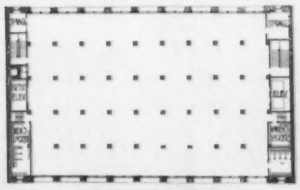
There are many contributing causes to the creation of a feeling of contentment among employees, yet it is most essential to have in order to secure their best work, their loyalty, and permanent service. Satisfactory wages, of course, is the first requirement, but in addition to that there are other things that are essential and some that have an important influence in securing contentment. Their safety, health, and convenience, as above argued, are essential ; and among the important influences should be mentioned their recreation, their entertainment and enjoyment. A workingman gets little time away from the factory for these things, and it has been found by those who have given the matter a fair trial that it pays to make provisions for the recreation, entertainment, and enjoyment of employees.

The old saying about boys working all the time applies in these days to men more than it ever did to boys because of the intensity of things and the nerve-

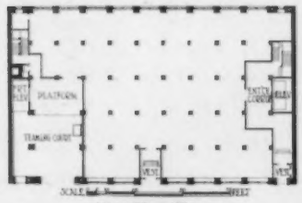
Ham Building, Chicago, Ill.
Perkins, Fellows & Hamilton, Architects



First and Typical Floor Plans
Arthur C. Dixon Building

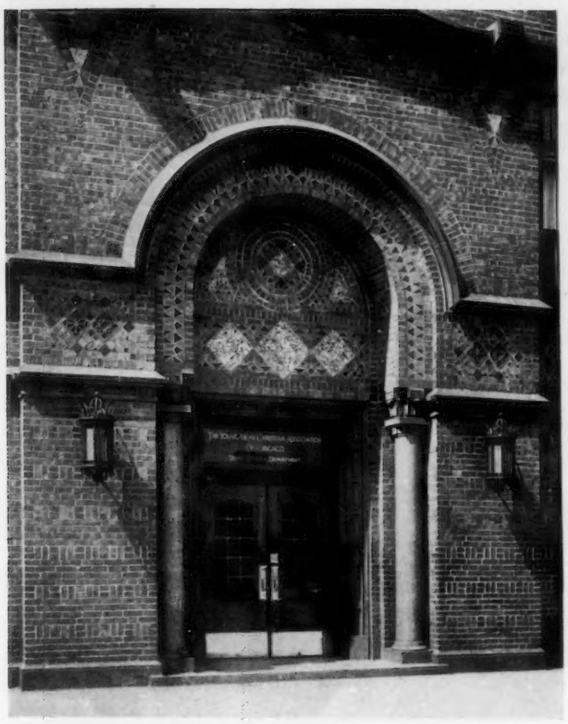


Typical Floor Plan



First Floor Plan
Ham Building, Chicago, Ill.

Arthur C. Dixon Building, Chicago, Ill.
Nimmons & Fellows, Architects

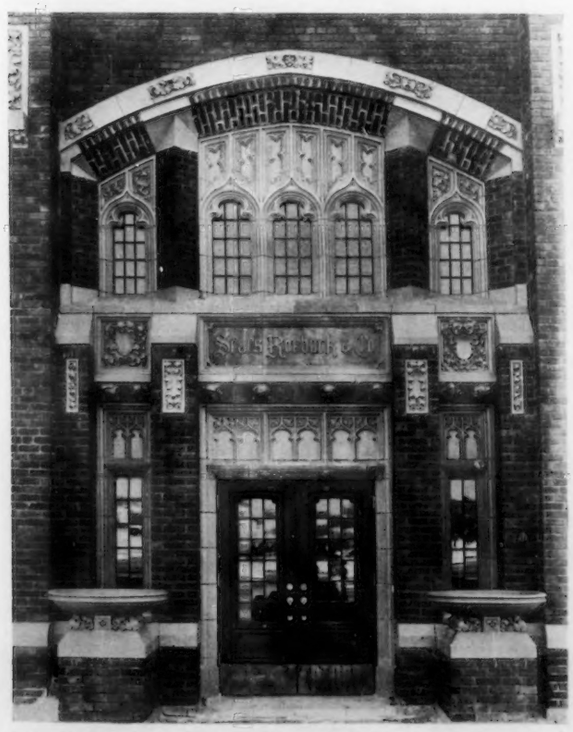


ENTRANCE TO Y. M. C. A. BUILDING, SEARS, ROEBUCK & COMPANY PLANT, CHICAGO, ILL.

NIMMONS & FELLOWS, ARCHITECTS

ENTRANCE TO AMERICAN BOOK COMPANY BUILDING, CHICAGO, ILL.

N. MAX DUNNING, ARCHITECT



ENTRANCE TO SEARS, ROEBUCK & COMPANY BUILDING, KANSAS CITY, MO.

GEORGE C. NIMMONS, ARCHITECT

ENTRANCE TO STEIN, HIRSH & COMPANY BUILDING, CHICAGO, ILL.

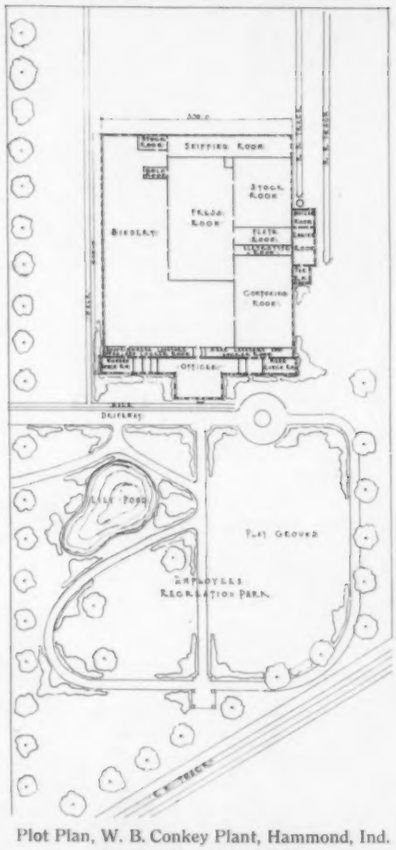
NIMMONS & FELLOWS, ARCHITECTS

racking methods characteristic of most modern day industries.

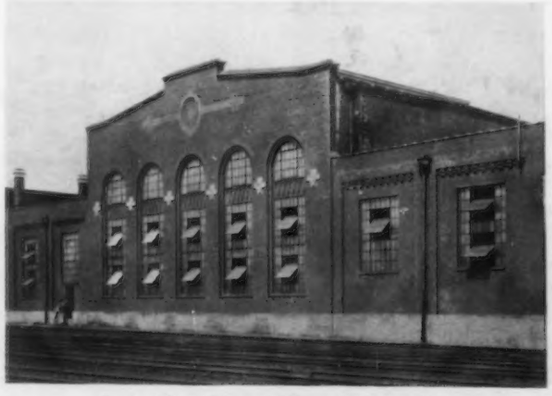
In addition to the above provisions for employees, the providing and arranging of the facilities of the building most favorable for the execution of their work is of course a most important matter which affects the owner as well. A building may be made to suit the work done in it most perfectly, or the reverse may be the case. The writer once saw a building so badly arranged that goods during the process of their manufacture were made to travel four times up and down the building before they were completed, while the fact in that case was that the material might have readily been assembled on the fifth floor and completely manufactured in one trip down to the shipping and stock rooms on the first floor. There is a great deal of lost motion and much time wasted both by machinery and men because many buildings are not arranged properly to suit the men or processes of manufacture. Poor light at the critical places in a building where the important work is being done has a great deal to do with the quality of the work; weak floor construction which does not safely permit things to be piled at points where it is desired to concentrate goods, posts in the road and ceilings too low—all such things and many more are the result of ignorance and inability to plan and arrange a building properly on paper before it is built, and yet these are the very things an architect is trained to do and provide for better than any one else.

We might continue and say a great deal more about defective factories and industrial buildings and point out the damaging effect they have upon the output and the success of the concerns occupying them, but it might not be interesting and we want to add a word more about the workman himself, and then we are done. The value of a workman does not depend alone upon his ability or dexterity in his trade. The uniformity, the quality, and the quantity of his product depends to an important extent on whether or not he is contented; whether he is well, happy, and interested in his work. It might be argued that those things have little to do with labor capacity, and the man only works because he is obliged to make a living; yet we positively know that the human machine will never operate at its best under force or compulsion alone. It will wear out sooner and can never perform its functions ideally unless there is at least contentment, satisfaction, and an interest in the work.

Entrance to Offices, W. B. Conkey Plant



Plot Plan, W. B. Conkey Plant, Hammond, Ind.
George C. Nimmons, Architect



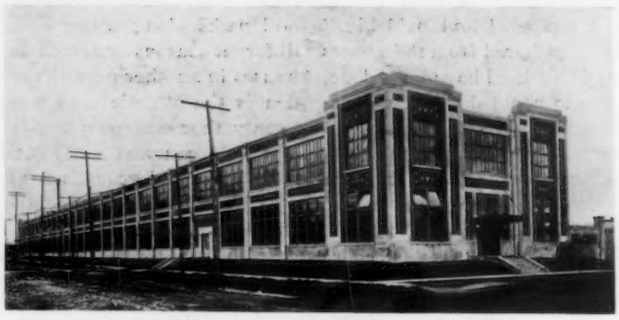
Central Bay of Engine House, St. Louis, Mo.
Klipstein & Rathmann, Architects

The sordid, unattractive, unsanitary workshop cannot, from the very nature of the case, produce the quality or quantity of work by the men which a first-class, properly equipped shop can. The human machine must have the right conditions in which to work at its best, and therefore it is absolutely true that every single thing which a manufacturer can do within reason to improve the conditions and surroundings of his men is adding just that much profit to his business, and, at the same time, adding just that much benefit to the lives of his employees. The rapidity and intensity with which a man nowadays is compelled to work absolutely demand for the best results that his condition and surroundings be greatly improved over the old state.

Again the workman's worth as a citizen in a community, and his true merit as a husband and father in his home, depend to a considerable degree on what his daily life is and the conditions surrounding it. There are at least eight hours to the working day, and they are sometimes long and weary ones. When these dreary times come it is a wonder that more men do not give up and succumb to the alluring freedom and independence of the vagabond. Nature evidently never intended a man to work quite as hard for his daily bread as factory workers do, and it is strange that they can resist as well as they do that inborn, persistent, and natural longing for freedom and the beauties

of nature which were all intended for man, but which the factory worker hardly ever enjoys.

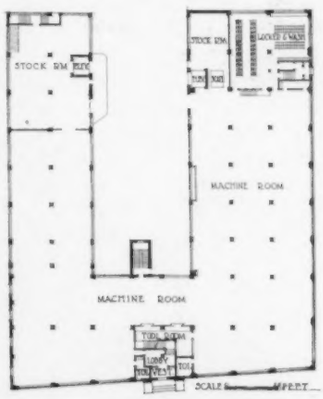
A man is swayed sometimes by small influences and it often only needs the slightest overbalancing influence of good to keep him steady and faithful to his duty. The factory and its surroundings are often responsible for just that needed influence for good or bad. In one case it may mean the ruination of a man and also his home, and in the other it may mean his salvation. This may seem to be enlarging the influence which the factory exerts over its employees, and yet any one who has seen the dreadful conditions of not only a few, but a great many, factories in this country knows differently. Some of them are so bad that the wonder is that human beings can exist under their conditions as long as they do.



Diamond Manufacturing Co. Building, Detroit, Mich.
Smith, Hinchman & Grylls, Architects

This, then, I believe, presents some of the principal phases and aspects of the factory and industrial building problem. The field is wide open to the architect — in fact, it invites him, because of his peculiar fitness for the work, and I do not believe that there is any agency that can do as much now for this big problem of our times as the architect.

Finally, we might very properly, in connection with this whole subject, undertake to summarize the results of those employers who have done the most for improving the conditions of workers and who have taken the lead in having their own plants developed architecturally, yet generalizing these results would be difficult and probably not as effective as the presentation of some concrete examples of the way these problems have been handled. We will, therefore, give a brief description of a few instances of these cases which may be taken as illustrations of what some of the most progressive concerns have done in this direction.



First Floor Plan

Eighteen years ago the printing and book publishing firm of W. B. Conkey Company moved from an ordinary seven-story building in Chicago to a new plant which had been specially designed and erected for them at Hammond, Ind. Up to that time the sawtooth roof which had been used with relatively small lights of glass in weaving sheds had not been applied to other kinds of factories in this country as far as known; but in Belgium a firearms plant, and in Paris an automobile factory, had been built with sawtooth roofs with successful results, and it was decided to use them for this printing plant. The entire working part of the factory was covered with a sawtooth roof with the glass surfaces 11 feet high facing north every 28 feet. The result was that the entire printing plant was almost as light as day. The press room was located in the center of the building and the activities of the plant revolved more or less in a circle around this press room and terminated in the stock or shipping room located next to the railroad tracks, as shown by the plan. As a part of the scheme for the building, it was decided to introduce some features which at that time were more or less novel in the printing business, at least. First were the long lavatories, absolutely sanitary, the locker rooms with individual lockers, the lunch rooms with hot coffee, the bicycle storage rooms for the help's wheels, the rest rooms, the library, the little hospital with its ready dressings and medicines, the recreation room with the piano and dancing floor, and, best of all, the little five-acre park in the front of the plant with its flowers and walks, its lily pond and recreation ground for the amusement and enjoyment of the employees. Recently the writer called on Mr. Conkey and asked him, "How about this park in front and all these things you have done for your people? After eighteen years' trial, can you say that it pays?" He replied, "If I were to do it all over again, I wouldn't change a thing, and I wouldn't omit a single thing that we

Arthur Colton Manufacturing Building, Detroit, Mich.
Mildner & Eisen, Architects

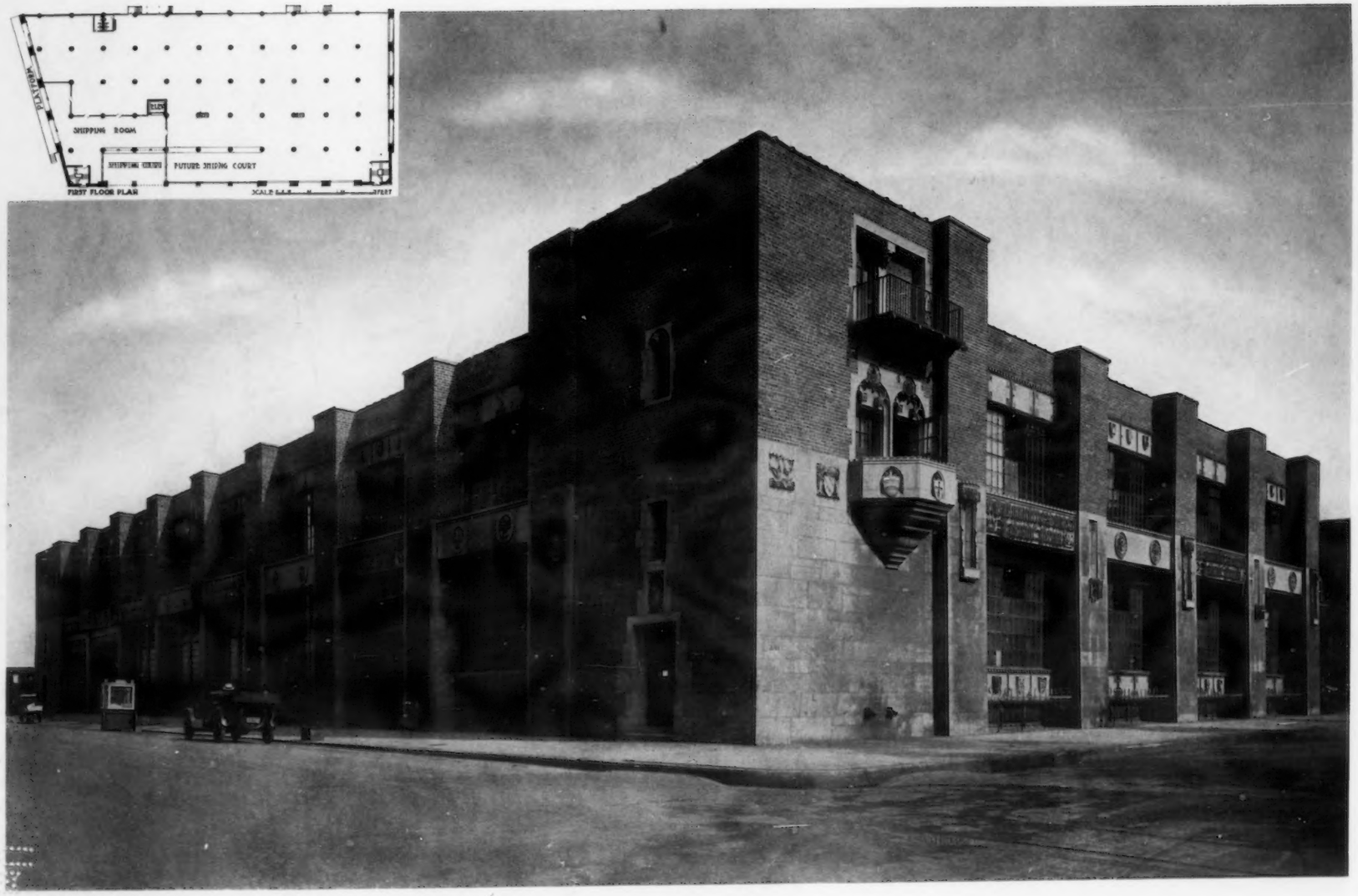
have done for our people; it has paid and paid big." Testimony of this kind might be gathered from the owners of many plants where things of this kind have been done, but it would be few of them who could date their experience back as far as Mr. Conkey, as eighteen years ago there was very little welfare work done among employees. They were left to shift for themselves. Now it is not at all uncommon and it shows a growing concern and regard for the welfare of employees by the owners.

As an exception to the rule in a class of factories which have been proverbially bad in their lack of provisions for employees, the Havana-American Tobacco Company's plant in Chicago may be of interest. The employees of cigar factories are usually drawn from the poorest class of people, and the interior of these factories are about as dirty and unsanitary as any that can be found. The odor of the tobacco in the cigar-rolling rooms of all these factories has a peculiar effect on the workers. It is inclined to make them go to sleep, particularly where the ventilation is poor. In the South, in Cuba and Florida, the workers have an entertainer in each room who keeps them awake while they work by reciting or reading something to them, usually a tragedy of some kind which is delivered with all the emotion and fire of a genuine Shakespearian performance. In the Havana-American plant the workrooms were made light, airy, and sanitary. In fact, the workers operate under saw-tooth skylights with fine mechanical ventilation. They are provided with plain, well lighted, and sanitary lavatories, locker rooms, and lunch rooms with hot coffee. Cigar makers are paid on the piece basis, and in the old plant they seemed to come and go pretty much as they pleased under the rules of their union. The difficulty was to get them to work long enough in a day to produce the number of cigars desired. The interesting feature of the new plant, however, is that they do not want to go home when the closing hour comes. They are so much more comfortable at work in this new shop than they were accustomed to be, and so much more so than many of them would be at home, that they have to be turned out in the evening when it is necessary to close down the plant.

There are two great industrial plants at which this welfare work for employees has been developed to a higher state and carried on at a larger scale than in any other places in the country. These are the plants of Sears, Roebuck & Company of Chicago, Ill., and The National Cash Register Company of Dayton, Ohio. Sears, Roebuck & Company's plant occupies a site two blocks wide and half a mile long. A street runs the long way through the property, dividing it into two parts. The buildings occupy the ground largely on one side of this street, and the land on the opposite side is taken up by the gardens and recreation grounds. There are ten thousand employees to care for. Provisions are made for serving them all with lunch in the plant. There are cafeterias, lunch counters, and restaurants where anything from a sandwich to a porterhouse steak can be bought at a price intended to cover only the actual cost so that there is no incentive on the score of economy to take time from their recreation hour in going to or from home at noon. When the weather is fine, there is diversion outdoors to suit almost any taste. In the sunken garden opposite the Administration Building there is a pond and pleasant walks and paths along which some of the best flowers of the different seasons are kept in bloom. There are greenhouses in another part of the grounds. Next to the garden is the athletic field where they had an audience of twenty thousand people at their last Annual Field Day. The field contains a regulation baseball diamond, a running track and grounds for various other outdoor sports, together with separate field houses for men and women with lockers, shower baths, and the usual equipment. Next to the athletic field are the tennis grounds containing thirteen of the finest kind of tennis courts — tennis and baseball being the favorite outdoor sports. At the other end of the grounds is the Sears, Roebuck & Company Department Y. M. C. A. Building, where there is a large gymnasium with running track in the gallery and all the modern apparatus in addition to a regulation swimming tank, bowling alleys, billiard rooms, etc. In the interior of the various buildings almost everything that could be devised has been furnished for the safety, health, comfort, and convenience of employees. They used to keep statistics on "headaches" and other ailments that occur to employees, and they found a surprising diminution of all these things after they moved from the old buildings into the new ones where modern ventilation, lighting, and good food at lunches were provided. There is a fully equipped hospital department done in white tile and sanitary materials in charge of a regular practising physician, nurses, and a dentist where a lot of good work is done continually. There are rest rooms, a library, and now plans are being considered for a banquet hall and place for holding large meetings. The employees are urged to save their money and at convenient places there are United States mail boxes into which they can drop their pass-books and savings. In connection with this there is a regular savings bank with receiving clerk, paying teller, and the other officers where they can transact almost any kind of banking business.

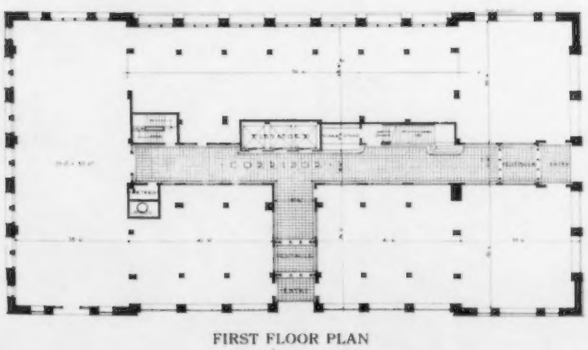
The National Cash Register Company of Dayton, Ohio, has, almost since its inception carried on a most praiseworthy welfare work among its employees. It is an immense plant, consisting of substantial and attractive buildings located in beautiful grounds. Almost everything which modern science and skill could do for the health and comfort of the employees in its plant has been done. It was not only done at first as the result of a kindly impulse, but it is a sincere and permanent policy of the firm which has resulted in keeping this work up with the development of the plant. The most striking thing perhaps which the firm has done for its people is the manner in which they have encouraged them to own their own homes and to beautify them with flowers and gardens. Certainly the city of Dayton ought to, and probably does, appreciate the great benefit of this plant to the city.

In conclusion the writer wishes to call particular attention to the work of other architects which has been very kindly contributed for illustration in this article. It is representative of present work in the Middle West and shows beyond doubt a wonderful improvement over what was formerly done. It clearly indicates that an earnest movement has been started in this locality to improve and perfect the architecture of factory and industrial buildings, and it illustrates well many of the arguments for which the writer has contended in this article.

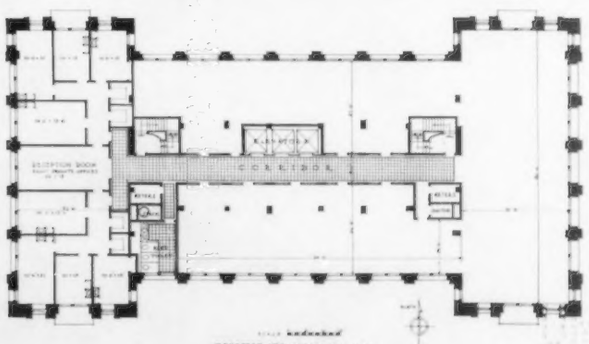


PRINTING HOUSE OF R. R. DONNELLEY & SONS COMPANY, CHICAGO, ILL.

HOWARD SHAW, ARCHITECT



FIRST FLOOR PLAN

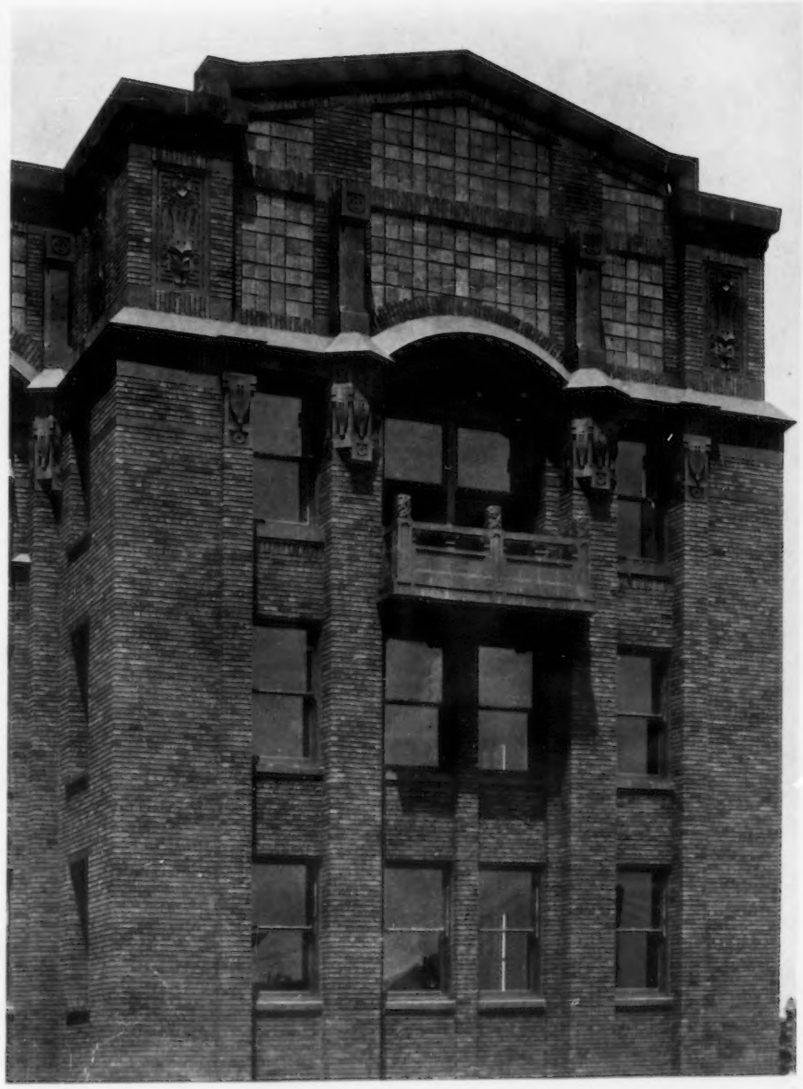


SIXTH FLOOR PLAN

FARMERS' TRUST COMPANY BUILDING, SOUTH BEND, IND.

PERKINS, FELLOWS & HAMILTON, ARCHITECTS

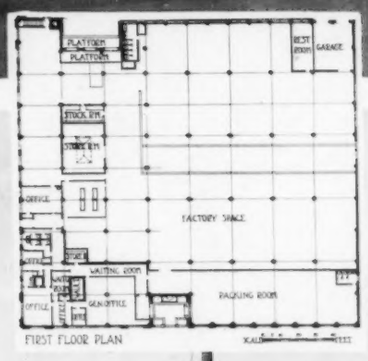
DETAIL OF LOWER STORIES OF END PAVILIONS

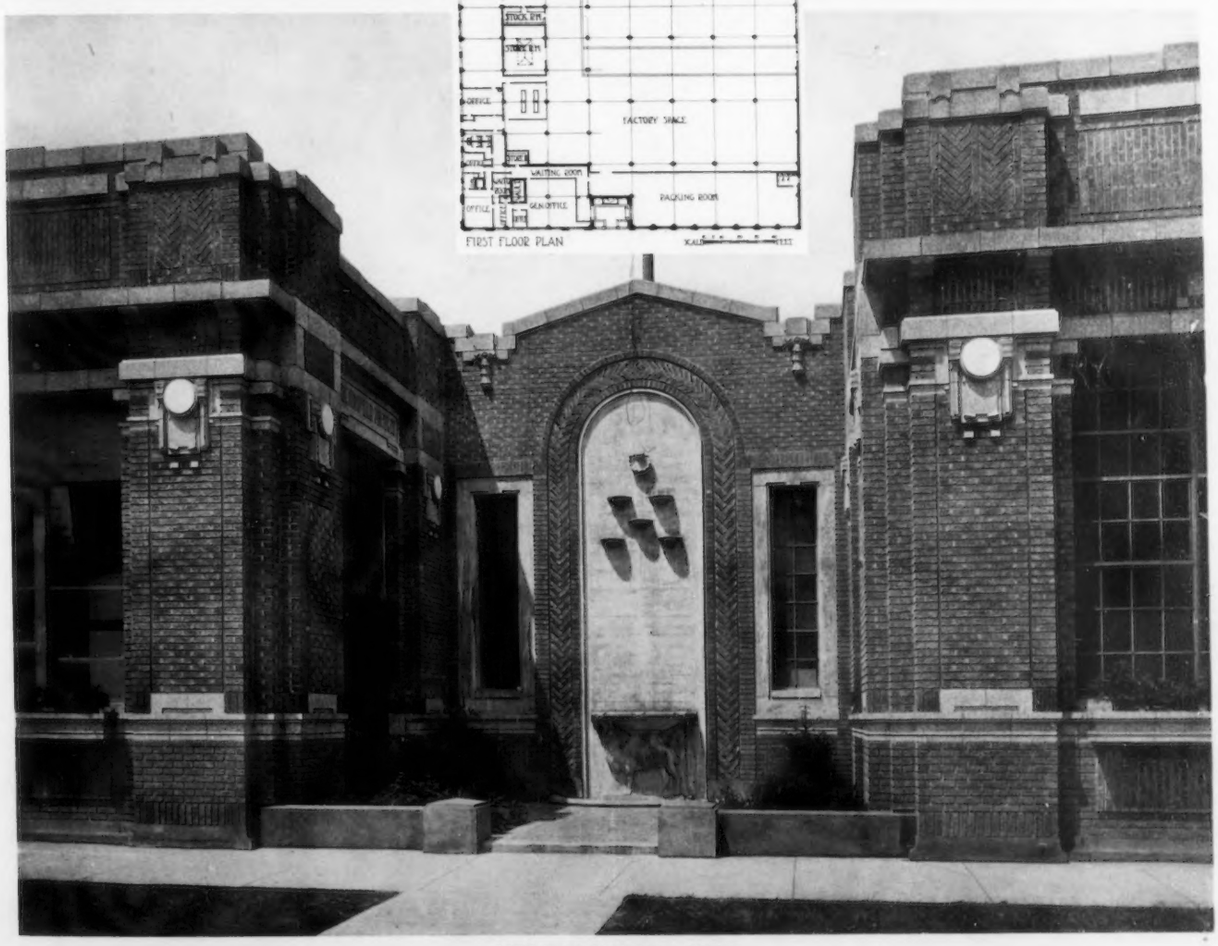


DETAIL OF UPPER STORIES OF END PAVILIONS

FARMERS' TRUST COMPANY BUILDING, SOUTH BEND, IND.

PERKINS, FELLOWS & HAMILTON, ARCHITECTS



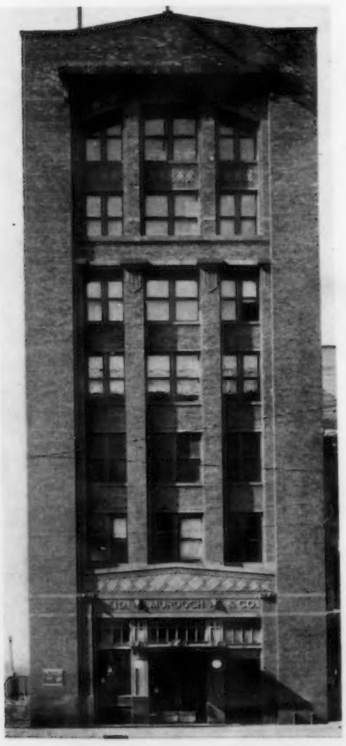


DETAIL OF ENTRANCE COURT

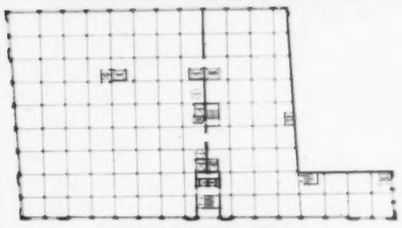
THE HUMP HAIRPIN MANUFACTURING COMPANY BUILDING, CHICAGO, ILL.

A. S. ALSCHULER, ARCHITECT

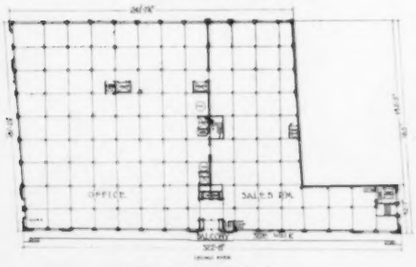
GENERAL VIEW FROM CHICAGO RIVER



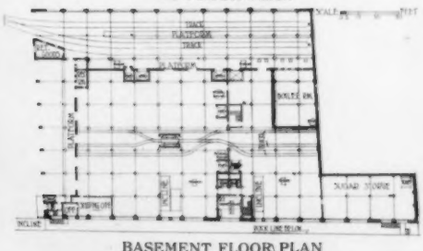
DETAIL OF CLARK STREET WING



TYPICAL FLOOR PLAN



FIRST FLOOR PLAN



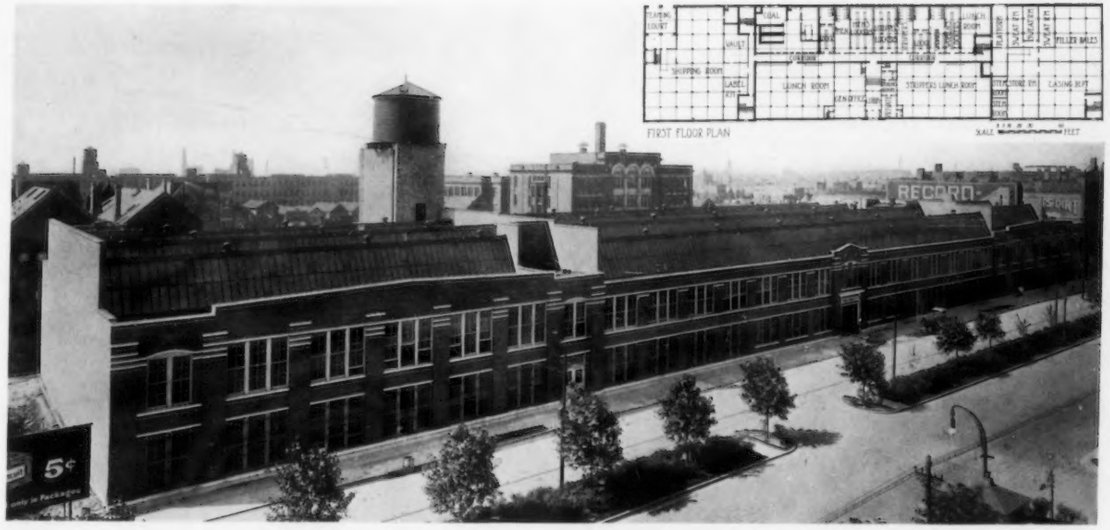
BASEMENT FLOOR PLAN

DETAIL OF TOWER

REID, MURDOCK & COMPANY WAREHOUSE, CHICAGO, ILL.

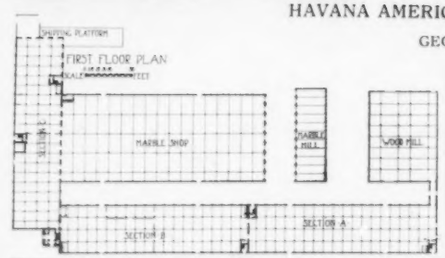
GEORGE C. NIMMONS, ARCHITECT

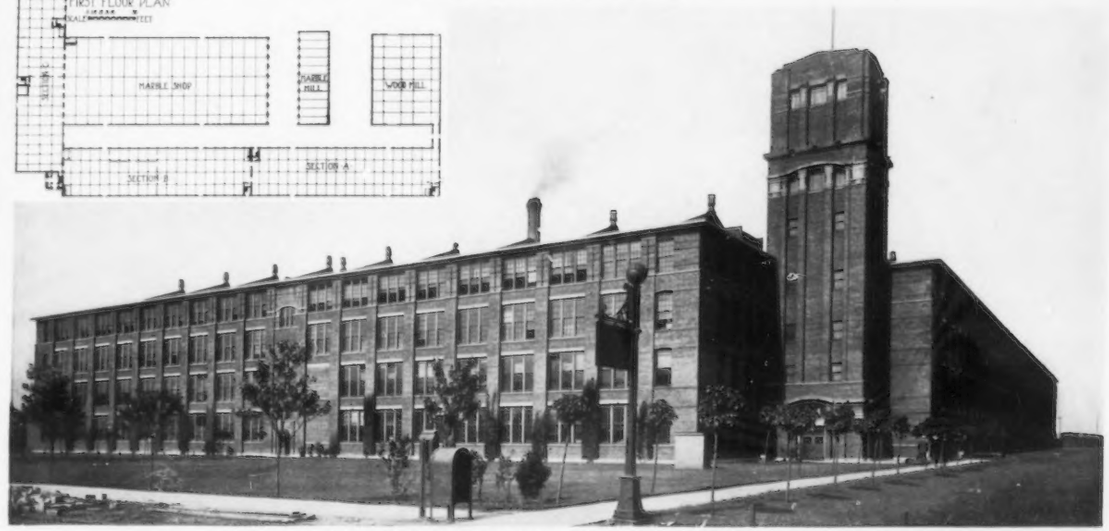
VIEW OF TOWER



HAVANA AMERICAN COMPANY BUILDING, CHICAGO, ILL.

GEORGE C. NIMMONS, ARCHITECT

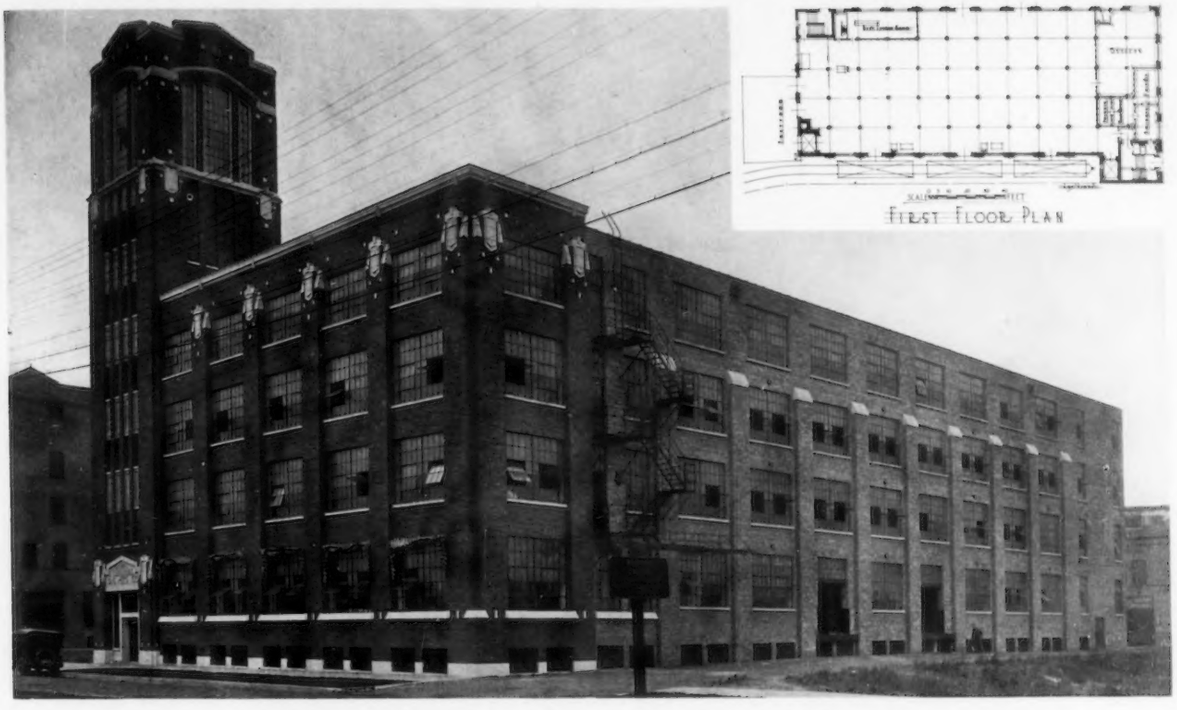




GENERAL VIEW OF PLANT LOOKING TOWARD SECTION C

LIQUID CARBONIC COMPANY PLANT, CHICAGO, ILL.

NIMMONS & FELLOWS, ARCHITECTS



CENTRAL BAG MANUFACTURING COMPANY BUILDING, CHICAGO, ILL.

S. SCOTT JOY, ARCHITECT

VIEW OF UNIT FRONTING ON WESTERN AVENUE

MIDLAND WAREHOUSE, CHICAGO, ILL.

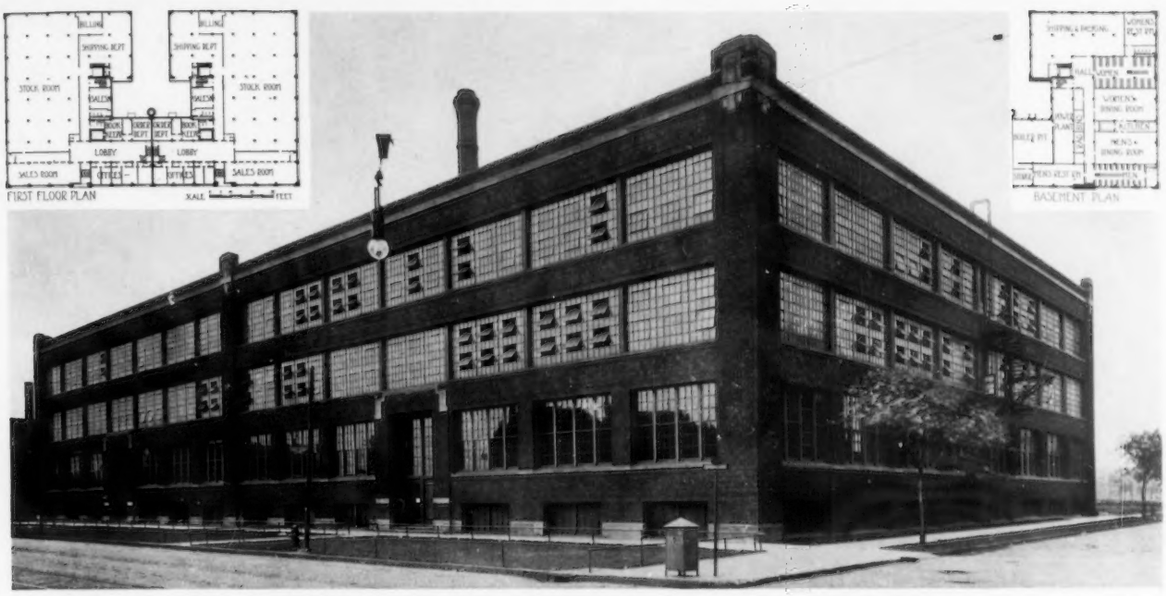
S. SCOTT JOY, ARCHITECT

FIRST FLOOR PLAN

KENT BUILDING, CHICAGO, ILL.
POND & POND, ARCHITECTS

FIRST FLOOR PLAN

TULANE BUILDING, CHICAGO, ILL.
POND & POND, ARCHITECTS



FACTORY BUILDING OF M. T. SILVER & CO. AND THE SUNSHINE CLOAK & SUIT CO., CLEVELAND, OHIO

J. MILTON DYER, ARCHITECT

WAREHOUSE OF THE W. BINGHAM COMPANY, CLEVELAND, OHIO

WALKER & WEEKS, ARCHITECTS

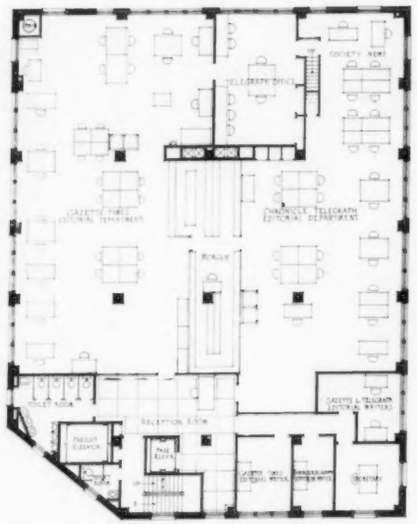
HIDE HOUSE OF A. F. GALLUN & SONS, MILWAUKEE, WIS.

BRUST & PHILIPP, ARCHITECTS

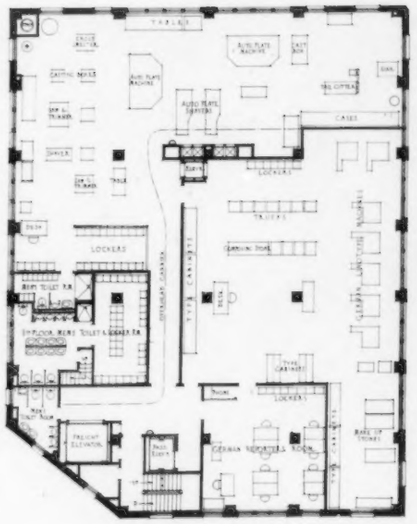
WAREHOUSE OF THE J. R. WATKINS MEDICAL COMPANY, WINONA, MINN.

GEORGE MAHER, ARCHITECT

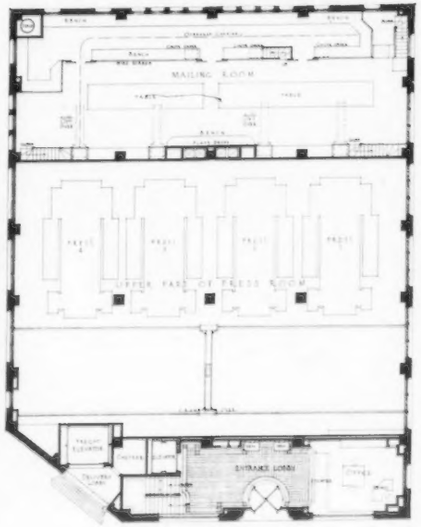
GENERAL VIEW OF EXTERIOR



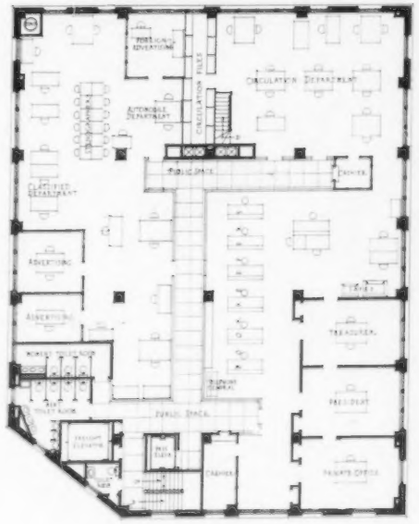
FIFTH FLOOR PLAN



SEVENTH FLOOR PLAN



FIRST FLOOR PLAN



THIRD FLOOR PLAN

THE GAZETTE-TELEGRAPH BUILDING, PITTSBURGH, PA.

EDWARD B. LEE AND JAMES P. PIPER, ASSOCIATED ARCHITECTS

DETAIL OF MAIN ENTRANCE

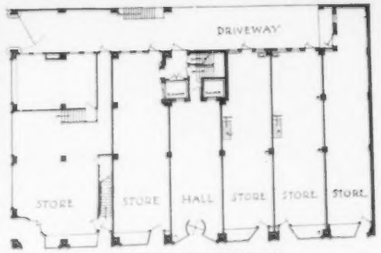
DETAIL OF UPPER STORIES AND CORNICE

THE GAZETTE-TELEGRAPH BUILDING, PITTSBURGH, PA.

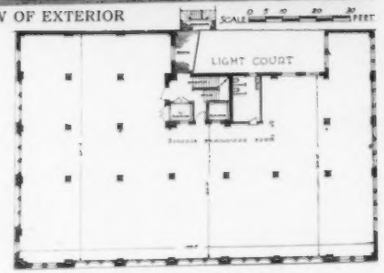
EDWARD B. LEE AND JAMES P. PIPER, ASSOCIATED ARCHITECTS

DETAIL OF LOWER STORIES

GENERAL VIEW OF EXTERIOR



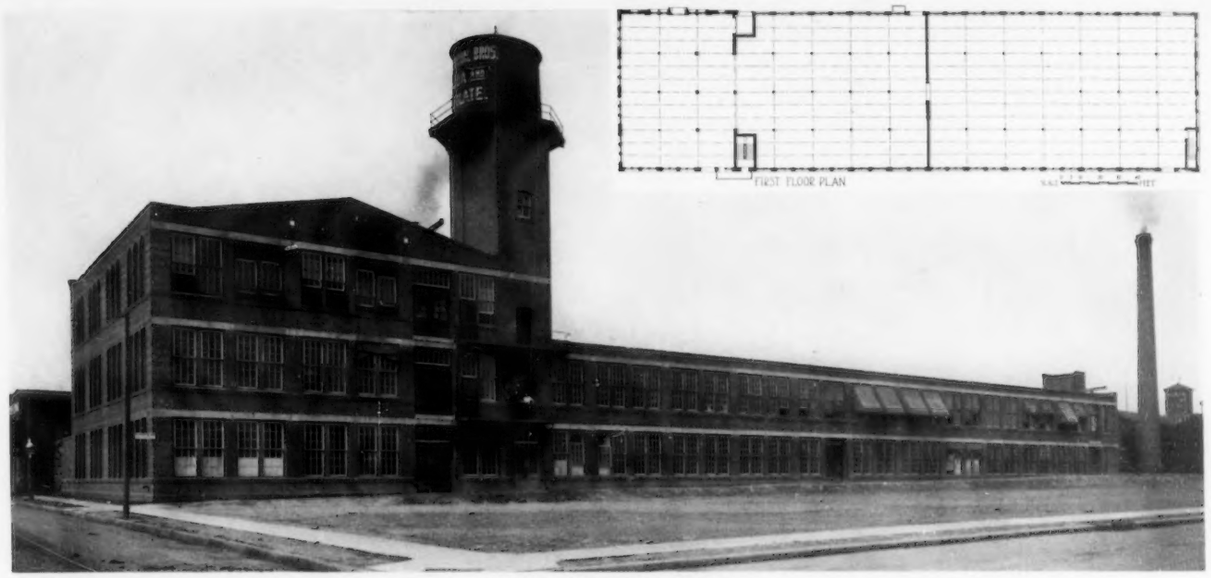
FIRST FLOOR PLAN



TYPICAL FLOOR PLAN

THE JOURNAL-COURIER BUILDING, NEW HAVEN, CONN.

MURPHY & DANA, ARCHITECTS

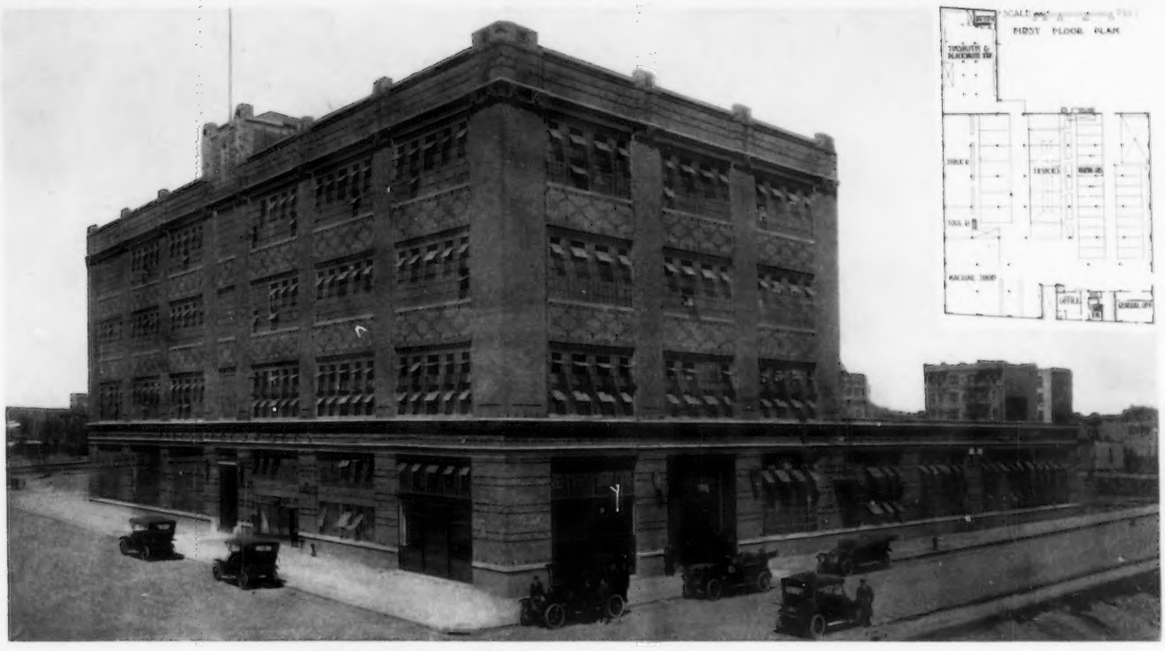


GENERAL VIEW FROM REAR

VIEW OF PRINCIPAL FACADE

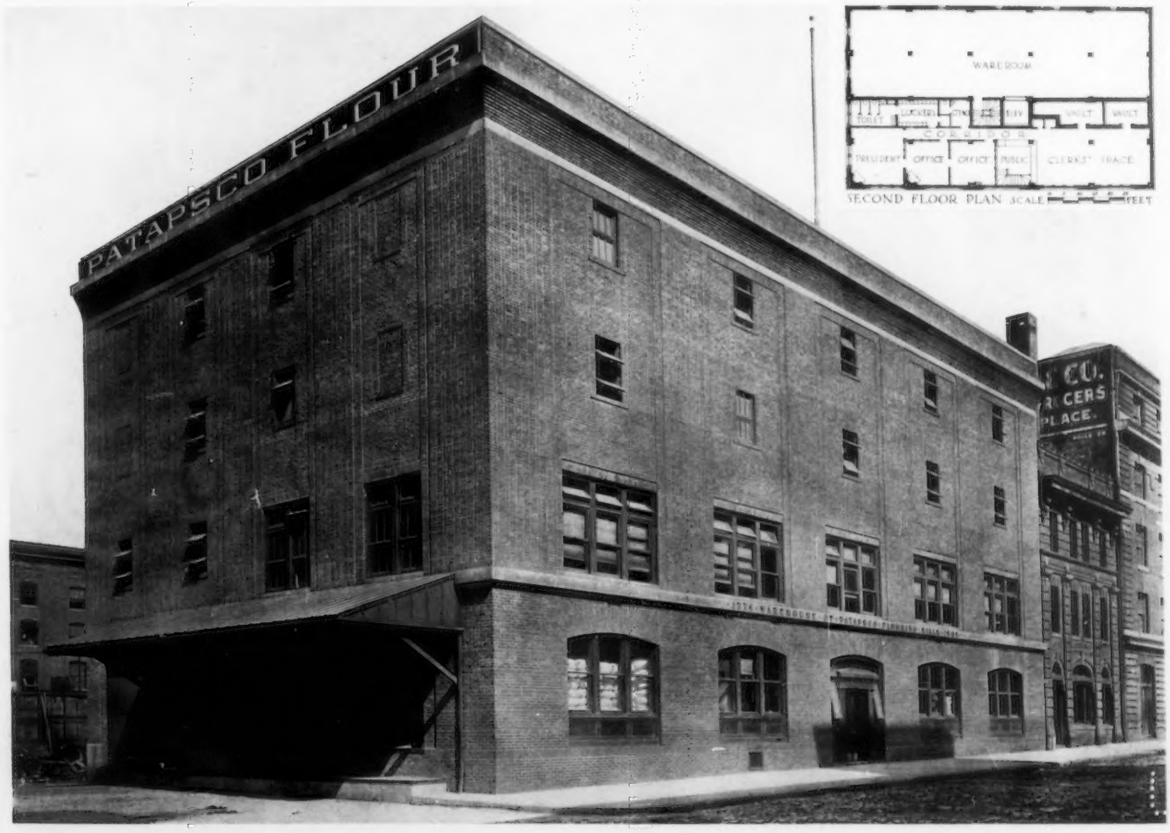
FACTORY BUILDING OF BLUMENTHAL BROS., FRANKFORD, PHILADELPHIA, PA.

STEARNS & CASTOR, ARCHITECTS



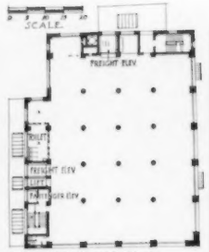
PIERCE-ARROW SERVICE BUILDING, LONG ISLAND CITY, N. Y.

GRIFFIN & WYNKOOP, ARCHITECTS

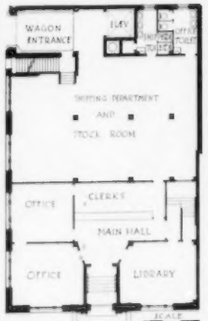


WAREHOUSE OF THE C. A. GAMBRILL MANUFACTURING COMPANY, BALTIMORE, MD.

PARKER, THOMAS & RICE, ARCHITECTS



TYPICAL FLOOR PLAN
E.J. SCHOETTLE BUILDING



FIRST FLOOR PLAN
W.B. SAUNDERS CO. BUILDING

W. B. SAUNDERS COMPANY BUILDING, PHILADELPHIA, PA.
JOHN T. WINDRIM, ARCHITECT

EDWIN J. SCHOETTLE COMPANY BUILDING, PHILADELPHIA, PA.
DAY & KLAUDER, ARCHITECTS

The Modern Manufacturing Building.

ITS DEVELOPMENT AS REPRESENTED IN RECENT STRUCTURES IN THE EASTERN STATES.

By JOHN J. KLABER.

THE factories built in recent years in the United States are very different from those of fifteen or twenty years ago. Then almost any structure with four walls and a roof was usually considered adequate for factory use; now, on the contrary, it is becoming generally recognized that the building of a factory is as deserving of study as that of a church or a residence.

The problem is, of course, very different from that presented by most other types of building. Early factory buildings followed closely the prevailing forms of private dwellings, with small windows, complicated planning, and inappropriate types of ornamentation, and it is only within the last few years that the true requirements of the problem have come to be at all generally understood.

The purpose of a factory building is, essentially, to conduce in every way to the most profitable manufacture of some article, be it shoes, electric lamps, or baby carriages. This point must never be lost from view in the preparation of the design, and everything else must be subordinated to it. But this does not mean that there must be nothing in a factory but the bare essentials of manufacturing. Other elements, of a more personal nature, may well enter, in so far as they are of value, either directly or indirectly, to the essential purposes of the building.

For this reason an interesting architectural treatment, provided it does not involve undue expense, is of great psychological value. The providing of pleasant and cheerful surroundings for the workman has been found to increase his output by stimulating him mentally to a higher degree of interest in the work in hand, and is therefore an excellent investment, even considered from a strictly selfish standpoint. And, apart from this, it is hard to understand why any manufacturer should refuse himself the personal gratification of owning a handsome building rather than a sordid and uninteresting one, particularly when, as is usually the case, the difference in cost is relatively small.

Nevertheless, one still finds that the majority of factories are constructed without any serious or intelligent effort at good design, and even where this has been attempted it has often been unsuccessful, because the designer has proceeded along lines fitted only to other classes of building. The better buildings, however, are often of great merit, and their example should be of value to others who have occasion to design similar structures.

It is in the Middle West, and particularly in such cities as Chicago and Detroit, that the most striking progress has been made. This is easily understood, in view of the more rapid growth of this section and its less degree of dependence on traditional types of design. But in the East, also, many excellent factories have been erected in the past few years.

The principal types of building that are used for manufacturing have become fairly well differentiated and may be divided, generally speaking, into three groups — the machine shop, the weaving shed, and the loft building. The last named is by far the most generally used and is that in which, architecturally speaking, the most interesting factory work has been accomplished. There are also various special forms of buildings, including power houses, coal bunkers, and the like; but there are few of any architectural interest, for these types have received even less attention from the architect than the factory.

Planning. The machine-shop and weaving-shed types of factory, both one story in height, have usually been constructed only where land was of small value, and have, in consequence, been generally of the baldest and most

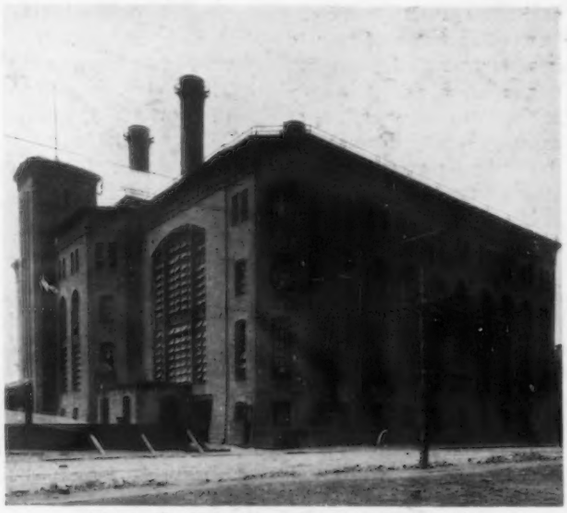
Otis Elevator Company Plant, Buffalo, N. Y.
Green & Wicks, Architects

utilitarian character. Their plans have, in general, been designed by engineers rather than architects, and based almost wholly on structural considerations. The necessity, in machine shops, for the use of traveling cranes to transport heavy machinery has produced an arrangement of wide bays that is familiar to all, but that has seldom received any architectural treatment, the structural forms being left in their most primitive and unadorned state.

The weaving-shed type is equally utilitarian, being used not only in textile mills, for which it was originated, but in various other types of manufacturing. The two types are frequently used in conjunction with each other and with other buildings several stories in height, the height tending to increase with the cost of the ground.

It is only in the multi-story or loft-building type that the plan becomes a matter of architectural interest. Here it is no longer a question of erecting sheds composed of simple posts and trusses, designed by an engineer, for in the loft building problems arise with which the engineer is altogether unfamiliar, and which only an architect is accustomed to solving.

The greatest and most frequent error is that of covering too great a percentage of the area of the lot, particularly in more or less congested cities. This inevitably results in defective lighting, with consequent poor workmanship and large bills for electric light, and often causes the abandonment of the building after a short period of occupancy. In New York City the losses to investors from this form of misguided enterprise have been enormous, and yet the same mistake continues to be made in new developments, each individual owner trying to put upon his neighbors the burden of providing the necessary open spaces. Where a single owner — individual or corporation — develops a large area at one time, this mistake is less likely to occur ; but in smaller buildings it seems that there is no way of preventing it except by drastic legal methods, and these are gradually being introduced in many cities.



Hudson Companies Power House, Jersey City, N. J.
Robins & Oakman, Architects

Natural light from a fairly clear sky will seldom penetrate into a building more than 30 or 40 feet with sufficient strength for manufacturing purposes, although the use of diffusing glass — prisms or factory ribbed — is an aid in this matter. Sixty feet, where the light comes from both sides, may be taken as an average width for maximum effectiveness, with the ordinary 12 to 14 foot ceilings, though in congested sections this is often exceeded, the less lighted parts being used for storage, circulation, or other suitable purposes.

The plans of typical factories show, in different degrees, this conflict between the necessity for adequate lighting and the desire for the maximum utilization of the available space. In many cases the ground floor almost completely covers the lot, the central portion having top light only, while in the upper stories courts have been left between the wings of the building. The arrangement of the Pierce-Arrow Building is somewhat special in that only the front part of the structure has as yet been carried to its full height, the wings being left for future development. This gives unusually good light for the time being, but when the building is complete, the lighting will be somewhat less excellent, though still far superior to ordinary standards.

The Auerbach Candy Factory shows unusually wide floors, exceeding 100 feet. This, no doubt, is due to the nature of the industry, enabling a large part of the space to be used for purposes requiring little natural light.

While it is evident from these examples that certain industries require more abundant light than others, there can be no doubt that in the vast majority of our factories the floor widths are excessive and that the output suffers in consequence. This is particularly true of the commercial loft building or tenant factory, a type that is becoming more and more general in the manufacturing districts of large cities.

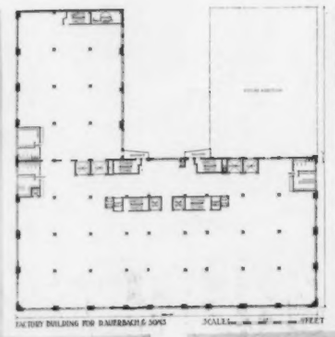
The internal arrangement is, in general, determined by economical column spacing, since the partitions usually carry no weight, being merely removable divisions of light construction, adopted as a matter of convenience and capable of being shifted about as the development of the business may require. For the usual fireproof construction, with average loads, a spacing of columns from 16 to 25 feet on centers is ordinarily the most economical, and such a spacing has practically become the standard for the best practice. There are, however, many exceptions to this rule, as in the Pierce-Arrow Building, where the exceptionally wide spacing of 30 feet has been used in order to accommodate large automobile trucks. But this wide spacing has necessitated the use of very heavy girders and would not be advisable except in a special case of this nature.

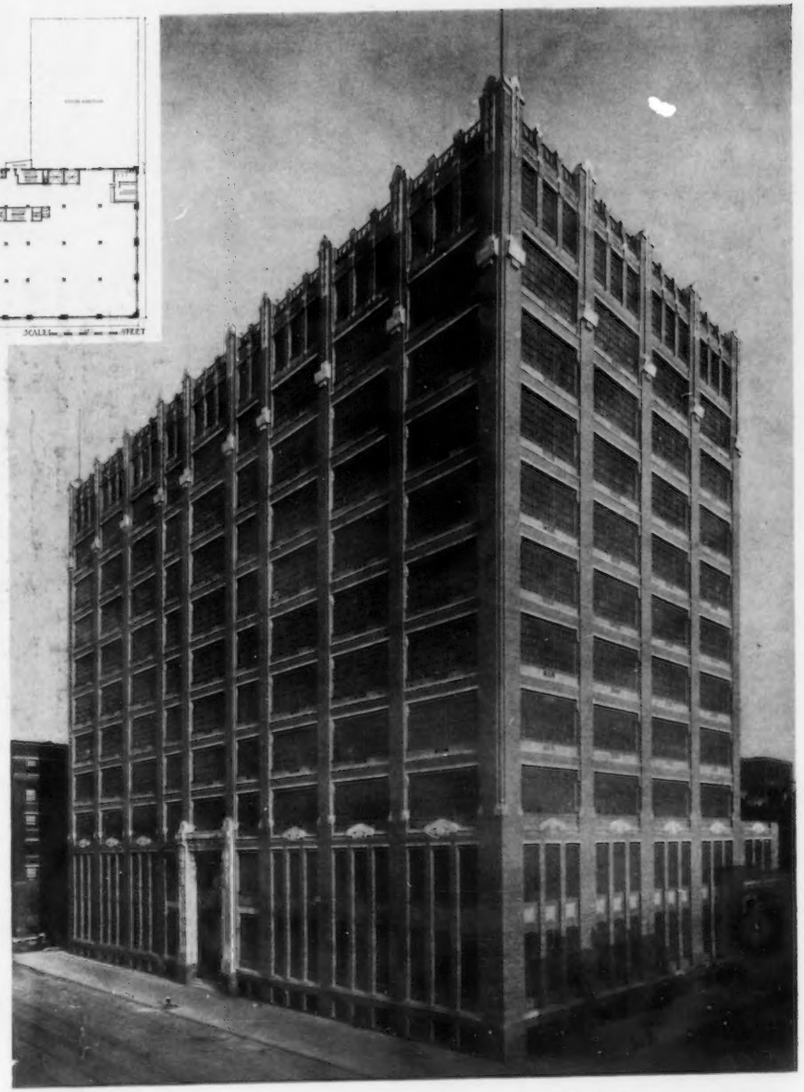
Where the floor areas are very large, they are often divided by fire walls, and although this hampers superintendence to some extent, it is a valuable measure from the standpoint of fire protection. Where such fire walls are used, all openings in them must of course be protected by adequate self-closing fire doors, otherwise their entire value disappears. These details, however, are usually controlled by law, the practice varying in different cities and states; and in the absence of local regulations the rules of the insurance underwriters may be taken as standard.

The planning and location of stairs and elevators are

NATIONAL BISCUIT CO. FACTORY, NEW YORK, N. Y.

A. G. ZIMMERMANN, ARCHITECT





AUERBACH CANDY FACTORY, NEW YORK, N. Y.

ROBERT D. KOHN, ARCHITECT

among the most difficult problems in buildings of this type. They should be located so as to be convenient to all parts of the building, and at the same time to interfere as little as possible with lighting, and to form the least possible obstruction to floor space. The solution of this problem must be determined specially for each individual case, depending on the requirements of the building and the shape of the ground. The location of stairs and elevators along party walls, where these exist, is a natural and obvious solution and one that is generally adopted. Where, however, the floor areas are very large, additional means of exit must be introduced, their location varying according to individual conditions.

The size of elevators depends mainly on the bulk of the materials to be handled and the number of employees to be cared for, and may be determined for passenger elevators by rules similar to those currently used for office buildings. The stairs, on the other hand, are usually fixed by law, being required as fire exits. The New York State Factory Law, for instance, requires that all stairways in factories erected after the passage of the law shall be at least 44 inches in clear width, with treads of at least 10 inches and risers not over 7¾ inches. Winders in stairs are prohibited, the stairs must be entirely enclosed in fireproof partitions for their full height, and must, in general, be continuous from the roof of the building to the street. They must also be proportioned to the floor area and to the number of employees, so that their planning is a matter requiring the greatest care.

For the support of overhead shafting the usual method is to install inserts in the underside of the floor slabs, spacing them from 18 inches to 2 feet or more on centers. To these inserts the shafting hangers are bolted. In other cases the hangers are bolted to wood strips, which are similarly fastened to the under side of the concrete beams, as in the Pierce-Arrow Building.

In another building a very ingenious and unusual device for supporting shafting has been used. Grooves have been cast in the sides of the concrete beams and girders, so as to allow the suspension of hangers at any point, by means of hooks clamping around the lower flange of the beams.

Fire Protection. Even when the building itself is of fireproof construction, its contents and fittings are often of an inflammable nature. For this reason precautions must be taken to protect the contents against the spread of fire, since insurance, while it may repay actual material loss, can never make up for the loss of time and good will caused by any serious interruption of an industry.

It has therefore been generally accepted as good practice that all openings should be protected as fully as possible. Windows in modern factories are almost universally provided with steel sash, which avoid the fire risk of wood sash at practically the same cost; and where wire glass is used, as is very generally the case, this protection may be considered almost perfect.

Doors are also made of metal or of metal covered wood, with wire glass panels where necessary. The doors leading to stairs are of particular importance in this respect. It is generally accepted that these doors should open outward, but it often happens that they swing into the passage, so that the crowd from upper floors prevents the opening of the door on the floors below. The fire towers of the Auerbach Candy Factory show an arrangement by which this danger is avoided by enlarging the stair landings at this point — a device worthy of more general adoption.

Elevator doors are usually made to slide and are as substantially built as is possible without undue expense. It is important that they should close their openings completely so as to prevent the spread of fire from one floor to another.

In addition to the above measures, automatic sprinklers are usually installed where complete protection is desired. These greatly lower the insurance rates, the reduction being enough to pay for their installation in a very few years. The pipes, in factory buildings, are suspended from the ceilings, no attempt being made to conceal them, as is often done in office buildings and stores.

The layout of sprinkler pipes must of course be arranged to fit the spacing of the ceiling beams, which varies considerably in different examples, but it should be as simple as possible while allowing a sufficient number of automatic heads. A floor area of 80 to 100 square feet per head is generally accepted as standard practice.

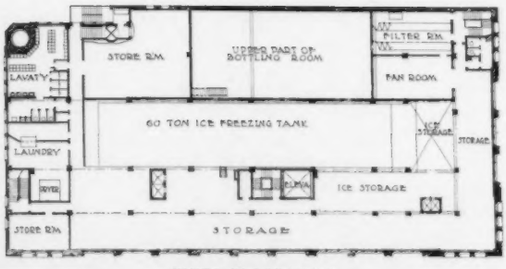
Where the buildings are heated, the pipes are kept constantly filled with water; but where there is danger of freezing, the dry pipe system is employed. Here the pipes are filled with air under pressure, so that the melting of one of the heads allows this air to escape and admits water to the pipes. When properly installed, an automatic sprinkler system is undoubtedly the most efficient fire protection, as it puts out the fire before it has time to become a serious danger. In some cases, however, goods have been seriously damaged by water from sprinklers, and there may be some types of industry where the damage from water would be so much greater than that from fire that their installation would be inadvisable.

Heating. Steam heat is generally employed in factory buildings, the exhaust steam from the power plant being the ordinary source of heat, so that the cost of heating is almost nothing. Where power is taken from the outside, a separate heating system must be installed, and the expense is accordingly greater, although the low cost of electric power service, in some localities, may make this arrangement more profitable. Ordinary radiators or pipe coils are used, depending on the available wall space, and where the floor area is large, additional radiators are hung on the interior columns. Pipes are also run around the skylights to prevent condensation and keep them clear of snow.

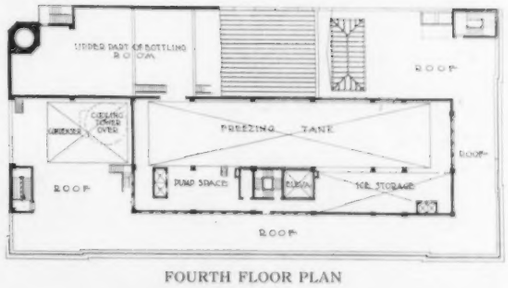
Architectural Treatment. It is only within recent years that the necessity of any architectural treatment for industrial buildings has begun to be recognized in America, and even now this recognition is far from general. In this matter we are less advanced than some of the countries of Europe, where artistic factory design is comparatively common. Nevertheless, we can show some examples of good design, though most of them are characterized by careful study rather than by originality of conception.

The materials used in factories lend themselves readily to certain types of decorative treatment, with an expense that is trifling, relatively to the total cost of the building. Concrete is, without a doubt, the most intractable of these materials. Used alone, it is difficult to obtain a pleasing

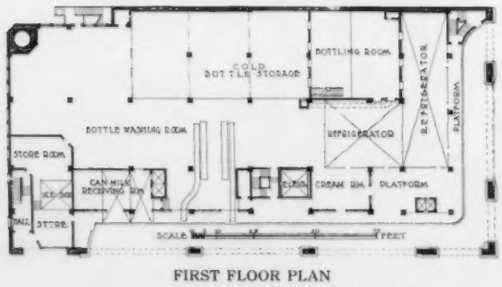
GENERAL VIEW OF EXTERIOR



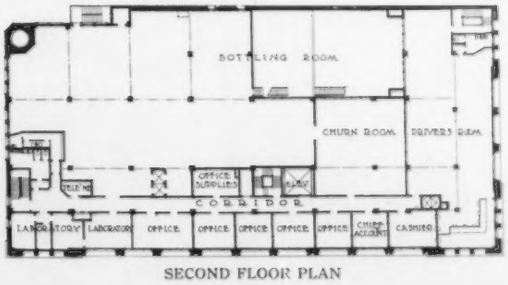
THIRD FLOOR PLAN



FOURTH FLOOR PLAN



FIRST FLOOR PLAN



SECOND FLOOR PLAN

DAIRY BUILDING OF THE SHEFFIELD FARMS, SLAWSON-DECKER CO., NEW YORK, N. Y.

FRANK A. ROOKE, ARCHITECT

texture or a satisfactory color. In combination with other materials, however, its possibilities are far greater. The Schoettles Building is an excellent example of its use, in combination with brickwork, the two materials being used in such a manner as to produce a decorative effect by emphasizing the constructive elements of the building.

The Sheffield Farms Building is an example of a front built almost entirely of white glazed terra cotta, adopted in this case to carry out the idea of the nature of the industry, the building being used for the handling of milk and other dairy products. The use of cows' heads and milk bottles as ornamental motives further emphasizes the same idea.

One of the most difficult problems that the architect constantly meets is the treatment of the necessary sprinkler tank. This is often, indeed more often than not, left in its natural stark ugliness to injure an otherwise good design. Sometimes, however, the architect has been able to persuade the owner to let him enclose the tank with a tower, usually the top of an elevator bulkhead, so as to harmonize it with the general lines of the building. An excellent example is the factory structure of the American Bank Note Company, which is notable for its economy of means and for its excellent study of proportion. The tower is obviously inspired from medieval Italian examples ; but the adaptation has retained only a suggestion of them, and is by no means archeological in design.

Gothic details have been used in some modern factories, as, for instance, in the Pierce-Arrow Building. While this detail is well studied and interesting because of the manner in which the company's trade-mark has been worked into a decorative motive, the principal merit of the building, in actual execution, is the color and pattern of the brickwork, which give it great distinctiveness.

The Auerbach Candy Factory, while its general lines suggest a Gothic inspiration, by the emphasis of the verticals — a most appropriate treatment for a steel framed structure — is carried out with details that are altogether modern. While details of this nature are more or less common in the Middle West, in the Eastern States they are extremely rare, more traditional types being used.

The Blumenthal Brothers' Factory presents a treatment differing from the others herewith illustrated, because of its less height — only two stories — and greater degree of decorative elaboration. Some of the motives used on the front are plainly inspired from the Italian Romanesque, while others suggest a more classical origin. The entire building, however, is most pleasing in effect, and some of the details are of considerable interest, particularly the door of the power house, where an ornamental effect has been obtained by the simplest means, through a combination of brick, tile, and cement, with a single spot of marble. The Blumenthal Factory is also interesting for its treatment of a gabled roof — a feature that is more or less unusual in modern factory design.

The interiors of most factories are of little artistic interest. Except for the offices, there is seldom any effort to produce anything more than is demanded by necessities of construction. Some Western examples show attempts at simple and inexpensive decorative schemes, chiefly by means of stenciled patterns ; but in the East this is almost unknown, although, in view of the very great improvement to be obtained at slight cost, the attempt would seem well worth making, particularly for the lighter types of manufacturing. It is to be hoped that attempts of this nature will become more common in the next few years, as the need for agreeable surroundings in working places becomes more generally felt.

American Bank Note Company Factory, New York, N. Y.
John J. Petit, Architect

MORGAN & WRIGHT MACHINE SHOP, DETROIT, MICH.
ALBERT KAHN, ARCHITECT; ERNEST WILBY, ASSOCIATE

IRON FOUNDRY BUILDING, CHICAGO, ILL.
RICHARD E. SCHMIDT, GARDEN & MARTIN, ARCHITECTS

GENERAL VIEW OF EXTERIOR

INTERIOR VIEW OF MAIN MOULDING SHOP

THIS building is one-half of a complete unit which will be 800 feet long and 415 feet wide. The design of the facade expresses the structural principle of the building, for in contour it follows the form of the roof and wall trusses which are so designed that a continuous glass area is had from wall to wall in the sides of the lantern. The double line of columns beneath the central bay makes provision for a traveling crane.

MALLEABLE IRON FOUNDRY BUILDING, GENERAL ELECTRIC WORKS, ERIE, PA.

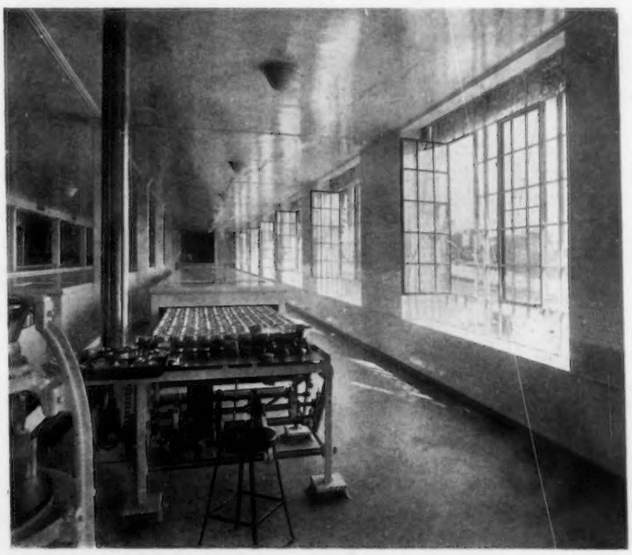
HARRIS & RICHARDS, ARCHITECTS

Natural Lighting of Manufacturing Buildings.

By O. M. BECKER.

NEXT to the selection of the site — with which the architect commonly has little if anything to do — and the determination of the type of building required by the location and nature of the productive processes therein to be carried on — with which the architect should have much to do — perhaps the most important single element in the design of industrial buildings is the provision for good lighting. The almost universal past indifference to the value of good and sufficient light, both directly in larger output and better product, and indirectly in better health and increased *morale* of the workers, only emphasizes the important duty of architects charged with industrial designing in this respect.

The modern factory plant is not merely a shelter for workers, tools, and materials; it is itself a tool. Not infrequently it is a greater factor in production efficiency than the machines or tools which it houses. Certain it is that dark, ill lighted work rooms are not only unhealthful for the workers in them, but are pretty sure to be dirty, ill kept, slovenly, and that the workers in greater or less degree become the same. Well lighted shops, on the other hand, unquestionably make for good health, relieve eye strain, tone up a working corps, ensure a better product with less waste, and reduce the accident hazard. Inasmuch as window area is usually less expensive than blank wall, certainly no more so with single glazing, it would appear that the only consideration that could be urged in ordinary work rooms, in limiting the lighting area, is that of loss of heat during the winter months. While there is some ground for this, it in no wise compares with the advantages already cited.



Effective Side Lighting

Wrought steel sash permits maximum strength for large openings with minimum obstruction. Movable sash may be designed to operate in any convenient way desired. This building, used in the manufacture of a food product, will bear studying for other features also.

It may be stated as a general proposition that all the wall area of a work-room building not essential as support for the structure should be given over to window openings. Wood-frame buildings can scarcely be considered for industrial purposes. Next to these the mill-construction building with brick walls permits of the least window area. The modern steel-frame or reinforced concrete-frame building with brick or concrete curtain walls is not only the most desirable industrial building, generally speaking, but permits and makes convenient the largest use of glazing.

In some instances architects appear to have gone almost to excess in this matter, the result being literally houses of glass built around steel frameworks. If kept reasonably clean, such buildings would approximate outdoor daylight conditions and would be desirable for some kinds of production activities perhaps. Allowed to become begrimed with dust and dirt, however, they soon reach the point where the object of such construction not only is defeated, but at all times presents the difficulties inherent in a hothouse, trapping the sun's heat and creating uncomfortable conditions on hot, sunny days.

The area required for satisfactory lighting naturally varies with conditions, not only of production, but of location. Where but little of the skylight is shut off by adjacent buildings, the window area should be at least 50 per cent of the wall surface exposed to the interior, and it may well be as much as 80 per cent. If light is cut off by surrounding buildings, the glass area requisite must be proportionately larger than would otherwise be necessary, according to the obstruction, and not infrequently may need to be all not essential to supporting the structure. In this connection it is necessary to consider also the possibility of future obstructions to light, and to make provision so far as possible to take care of contingencies.

The width of the floor also must be considered. If greater than 40 or 50 feet, all available wall space would better be glazed. It is, however, very undesirable to make use of floors of a width very much greater than this, not only because of the difficulties in the way of good lighting, but because of fire hazard and certain difficulties in ventilation, if not in heating. Experience has shown that 60 feet in multi-story buildings intended for general manufacturing purposes is quite satisfactory. This width is sufficient to permit the arrangement of machinery to good advantage, and satisfactory lighting if light can be admitted from both sides. With this width, however, ceilings must be 12 to 15 feet above the floors, and window openings are to reach from about the ceiling line to a

Effects Obtainable with Sawtooth Roof Lighting

In spite of the forest of belts and wilderness of transmission and countershafting here, the daylight effect is remarkable.

point say 3 feet above the floor. In the case of warehouses less light is essential, and where it is desirable to store materials against side walls the windows may have their sills considerably higher. Even in buildings intended for this use, however, care must be taken not to shut out light to the point where obscurity results.

The form and location of window areas will depend upon the type of building and materials of construction. In best recent practice in the case of reinforced concrete frame structures the light openings cover all the space enclosed by the structural members except low curtain walls for some distance above the floor level. In steel frame buildings, whether covered by brick or concrete, a similar area is feasible and generally desirable. In a brick structure where the walls form the supporting members, obviously the openings must be reduced to a point where there will be adequate strength in the masonry walls.

The form and style of sash is equally important with the size and location of light areas. The customary styles of wood sash, or of wood protected by metal sheathing, are scarcely feasible where openings are so large. Besides being clumsy in operation and difficult, in such situations, to design with architectural effect and strength at the same time, they take up a considerable proportion of the opening. Pressed metal sash are open to a similar objection, although they avoid the fire hazard of the wood. Wrought steel sash are, all things considered, most desirable in industrial buildings. They admit something like 20 per cent more light than the ordinary form of sash, are stronger and stiffer, offer excellent fire resistance when suitably glazed, do not stick in operation, and permit almost unlimited ventilation.

The matter of ventilation is one that must be considered in connection with windows. While it is entirely feasible to design and install reversible heating plants so that the same may be used for providing suitably conditioned air during the warm season, owners are slow to see the need for this, and in most instances it is necessary to provide for summer ventilation through a large use of movable sash. Sliding sash are feasible but permit at the best, under customary conditions, but half of an opening being utilized. Furthermore they require balancing either by use of weights or springs, or by being counterbalanced one against the other. Pivoted sash are to be preferred on both accounts, as well as because simpler mechanically, less expensive, and more easily operated, either singly or collectively. A vertical swing permits adjustment so as to obtain greatest advantage from outside breezes; but in most situations the horizontal pivot is preferred. This is especially the case where light-diffusing glass is used in the sash.

Both side walls should be provided with windows, unless of course the building is much narrower than already indicated as allowable. Much has been said in recent years of the ill effects of cross lighting. The ill effects may be admitted; but they result not so much from the admission of light from two directions as from misdirection of the light. It is essential that there be an even diffusion, no shafts of light, and obscure depths. With a moderate width of room and a large glazed area this will usually take care of itself. Where these conditions are impossible, or where adjacent structures shut off light, it is necessary to make use of diffusing glass. For this purpose ribbed or prism glass is most satisfactory and easily kept clean. The latter is better than the former. The ribs or prisms are to run horizontally — never vertically unless it is necessary to direct light into some corner

Method Combining Advantages of Sawtooth Roof and Lantern Lighting and Ventilation

Supporting trusses and continuous sash, as here applied to the sawtooth, in combination with large side lighting area, make it possible to get the much desired north light effect in buildings of the foundry and erecting shop type.

not otherwise illuminated. Maze glass breaks up light more effectively, or rather diffuses it more completely in all directions, and is to be used in comparatively narrow buildings, say up to 25 or 30 feet wide, to break up direct sunlight and secure an effect somewhat resembling the much desired north light. In such buildings so glazed the windows should be on one side only. In wider rooms, say to 60 feet, factory ribbed glass is required; and in still wider rooms, sheet prismatic glass is required. The ribs as mentioned are to be parallel to the floor.

In specifying glazing the mistake should not be made of setting the whole window area with translucent glass. Work people at all sorts of employment, whether manual, clerical, or mental, are subject to eye strain and headaches, and the train of ills consequent if they have no relief for the eye muscles. Such relief is most simply had by frequent looks away from the work in hand, preferably out of a window. The lower portions of all windows therefore should be glazed with plain glass. It may be pointed out also that plain glass is much more easily kept clean and is cheaper — two very good reasons for its use where diffusing glass serves no purpose. It should be borne in mind likewise that provision facilitating cleaning should not be omitted. In some types of building it may be necessary to provide platforms or supports for platforms. In most cases, however, it will be sufficient to require hooks or bolts for portable scaffolds or platforms, or for the cleaner's harness.

Direction of Light Has Much to Do with Fatigue and Consequently with Efficiency in Production

Work benches and machines ought not be so placed as to compel workers to face the light, or to receive it on their backs. This arrangement is good. A better would be to set benches at an acute angle with the light source, so as to permit momentary glances outside with least effort and distraction from work.

Facing the light, even when well diffused, is very fatiguing to the eyes, as universal experience should teach. The consequence of work benches and machines being disposed so that workers must face windows therefore is pernicious and mischievous and results in measurable loss in production and spoiled materials. It is entirely feasible to arrange both machines and work benches so the light will fall upon the work from the side instead of from front or back, which latter is almost as bad as the former. A still better method is to dispose them at an angle less than a right angle, to make it possible for work people to glance out the window momentarily to relieve the eye strain with least effort and loss of attention to the work in hand. This, of course, applies in the case of side lighting such as is necessary in multi-story buildings.

Another matter that must receive cognizance, especially in buildings of the type thus far under consideration, is that of possible additional buildings so nearly adjacent as to interfere with the influx of light. When adjacent land is in the control of the owner of the plant involved, this can usually be taken care of. Otherwise it is necessary to plan against the contingency of another owner disregarding the light needs of your buildings.

Example of Roof Lighting by Means of Flush Skylights

In this foundry the chief dependence for illumination is the large area of flush skylights. These can be made very effective, but involve some difficulties and disadvantages also.

There can be no question of the superiority of well designed methods of lighting from the roof; and wherever feasible, as manifestly it is not in multi-story buildings except for the top story, this should be utilized to the full either as a sole method or to supplement side lighting. Two objects are of primary importance in roof lighting: the avoidance of the glare and heat of direct sunlight and even suffusion of the working area. The latter can be accomplished by almost any method that really takes advantage of the diffused light of the sky, and as previously pointed out both can in considerable measure be secured by proper installations of side lights, although not to the same degree as well designed roof lighting.

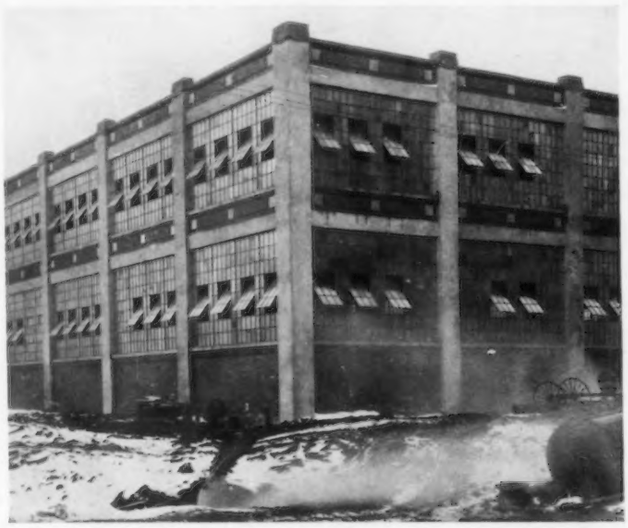
Until recently the usual method of lighting from the roof, used in large buildings of the foundry or erecting shop type, was by use of "monitors," improperly so called, or "lanterns" surmounting the roof angles. Usually this method has been used in combination with side lighting, and frequently some such method is necessary yet in very wide and high buildings. Such lanterns perhaps facilitate ventilation, but certainly lack in effective illumination. A recent modification of the lantern method is a great improvement in that it takes advantage of a sky exposure either by swinging batteries of sash, or by being set at an angle to the vertical, or by both methods. The sides of such a lantern, when it has more than one glazed side, are set much farther apart than has been customary, and the effect is virtually that of a sawtooth roof with a limited number of teeth. A shop of this type can be as well ventilated and about as well lighted as out of doors. Experience has shown that in a foundry so designed the moulders tire less and produce considerably more output.

The flush skylight, of comparatively recent origin, is an improvement upon the ordinary lantern or monitor lighting. So far as amount and intensity of light is concerned over the area penetrated this method fills the requirements. The difficulty generally is that the light is too intense and along with it there is much of the hothouse heat effect of captured direct sun rays, making the working areas frequently uncomfortable and at times intolerable. Of course in hot seasons the under surface can be whitewashed or otherwise covered so as to intercept some of the light. All these methods, however, have disadvantages and are not recommended. The substitution of more or less translucent fabrics or similar materials is not satisfactory either. The use of diffusing glass in considerable measure reduces the ill effects, but introduces another difficulty in maintaining the same in a sufficiently clean condition. Non-leaking settings are now available and are essential. There must also be provision for taking care of the drip of condensation in buildings for most purposes. The necessity is obvious in most kinds of manufacture.

Where such a roof is feasible, glass tile in combination with clay or cement tile are available, as are cement tile with water-tight glass settings. This forms a very satisfactory roof for many purposes.

The sawtooth roof introduced into this country a few years ago, when properly designed, is undoubtedly the best method of lighting now available in buildings to which it is adapted. It is, however, of prime importance that such a roof shall conform to the requirements of good sense, otherwise as has not infrequently happened the very object is defeated.

A sawtooth roof, then, takes advantage of light from the north in the northern hemisphere, avoiding direct sunlight so far as possible. The teeth are not so small that the structural and unglazed parts cover so much area that the aperture is greatly reduced. And the glazing is set at a suitable angle to the perpendicular — in the latitude of New York approximately 30 degrees. The angle may be greater farther north, the purpose being to make it maximum without at the same time permitting direct sunlight to enter in appreciable amount. Setting the sash vertically, as has been done in many instances, practically defeats the purpose of such a roof.



In Very Wide Buildings it Is Necessary to Diffuse the Light Admitted so as to Reach and Evenly Illuminate the Central Portions of Work Rooms

This is accomplished by use of various styles of moulded glass. Ribbed or even prismatic sheet glass is required in case of very deep rooms. The ribs must run horizontally; and the lower portions of the sash should be glazed plain, so as to permit workers to relieve their eyes by looking out.

In early roofs of this type there were difficulties arising in connection with the drainage of the valleys. The simple expedient of short valley slopes draining through the roof by conductors following the supporting columns or other structural members reduces this difficulty. The use of horizontally ribbed glass here also aids in distributing light thoroughly. For reasons previously mentioned — the relief of eye strain in the workers — it is desirable that all buildings lighted from the roof should have also some plain glazed side windows if the work carried on is at all exacting. In many kinds of industries of course this is unnecessary.

A word is desirable as to the conservation of light also. In many work places the interior soon becomes grimy, if not dirty, even if the surfaces and contents of the rooms originally were light colored. Dark surfaces absorb light, whereas light tints reflect and diffuse. It is therefore important to keep interior surfaces clean and light colored. Whitewash is most commonly used, and if sprayed on the walls is the cheapest material. It either flakes off, however, or in time becomes thick with repeated coatings and is not so desirable as flat paint or other coating that adheres closely and is practically non-absorbent. Machinery, customarily painted black, should likewise be light colored. White is not so effective or desirable as a greenish gray, for color also bears a direct relation to fatigue resistance and it has been proven by carefully conducted tests that gray tones promote the maximum efficiency.

The Sanitary Equipment of Industrial Buildings.

By HAROLD L. ALT.

INDUSTRIAL buildings may be roughly classified — as far as sanitation goes — into two distinct groups. First, those in which high class work is performed by more or less skilled operators, some of which are likely to be women; and, second, those in which rough and heavy work is done, these usually being occupied entirely by men. To the first group belong all the factories for small metal parts and devices, clothes, cameras, and so on; to the second belong such buildings as foundries, planing mills, car shops, shipyard buildings, steel works, and similar establishments.

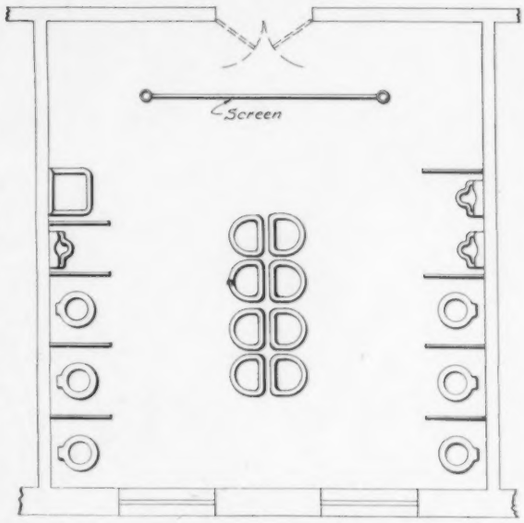


Fig. 1. Typical Arrangement of Toilet Rooms in Buildings of the First Class

The architect will find himself more at home in the design of plumbing for buildings of the first class, the fixtures for them being more or less in accord with standard plumbing practice for all good buildings; whereas in the second class the employees, from the rough and begriming nature of their work, do not appreciate nor need elaborate fixtures, and to any one accustomed to what is commonly termed "first-class work" the fixtures and substitutes for fixtures (which are sometimes found to give the most satisfaction in buildings of *this* kind) are rather startling in their apparent crudeness.

In designing sanitary work for such buildings the following requirements must be considered: state labor law, local building requirements, city plumbing ordinance, number of employees, sex of employees, locations of larger groups of employees, distance to toilet facilities, initial cost and upkeep.

The buildings of the first class employ good, substantial fixtures with some modifications for serving a large number of employees.

The state labor law usually provides for the number of fixtures, ventilation of rooms, number of lockers, etc. The building code generally covers the type of construction, thickness and material of floors and walls, and other details of construction, while the plumbing code is likely to cover the piping of the fixtures and methods of venting same. These may overlap or interlock in a more or less confusing manner, and a careful study of each must be made in order to meet all the interrelated provisions.

In general the toilet-room floors should be of a waterproof substance, concrete being the material commonly employed; this should be finished around the wall with a sanitary cove base and the walls should be of non-absorbent character, if possible. The toilet-room partitions should also be of an impervious nature, the favorite materials being iron and slate — iron generally considered the more serviceable.

The number of fixtures is always a subject for discussion, but the labor law of one of the greatest manufacturing states in the union allows a sliding ratio of water closets to occupants running from 1 to 17 for small numbers up to 1 to 30 for 300 or over. Urinals are allowed to be substituted for men's water closets up to one-third of the total men's fixtures required; thus:

For 1000 men, $^{1000}/_{30}$ equals thirty-four fixtures required, of which one-third can be urinals, or eleven, and the remaining twenty-three fixtures water closets. If the employees consisted of 500 men and 500 women, then the number of fixtures for men would be $^{500}/_{30}$, or seventeen fixtures, of which one-third, or five, would be urinals and twelve water closets. For the women the number required would be $^{500}/_{30}$, or seventeen water closets.

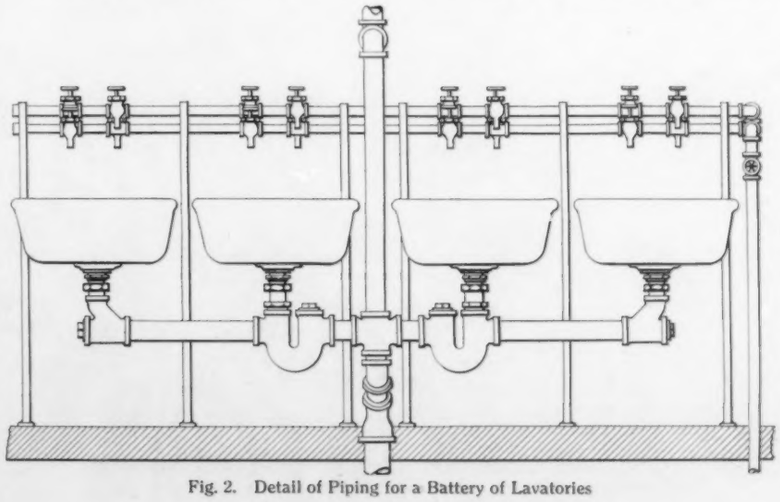


Fig. 2. Detail of Piping for a Battery of Lavatories

The lavatories under the same law are based on from 1 to 20 to 1 to 25 employees unless lead, chemicals or other poisonous substances are used where the ratio is made 1 to 10. The writer personally

believes that the ratio of 1 to 20 is entirely too high and that 1 to 10 should be used at all times to encourage personal cleanliness among the employees.

Among buildings of the first class the tendency is to separate the lockers and washing facilities, placing the lavatories or wash sinks either in the toilet rooms or adjacent thereto, as shown in the typical arrangement given in Fig. 1. In these better class buildings it is the custom to provide separate porcelain lavatory bowls,—often buff in color,—although enameled iron can be secured at less cost.

The piping of a large number of bowls with a separate trap, waste, and vent for each bowl rapidly runs into a considerable expenditure. Permission can usually be secured from the local authorities for work of this kind to place from one up to six lavatories on one 2-inch trap. This dispensation is often obtained on account of the local influence possessed by the owners of a large plant and the realization of the authorities that such work is not rightfully subject to all the refinements included in the scope of modern sanitation.

The piping for a battery of lavatories such as is shown in Fig. 1 is given in Fig. 2, where two bowls are shown connected to each trap. This arrangement can be enlarged by connecting more bowls on the end of the 2-inch waste until the limit of six is reached. Over this limit the stopping up of a single trap would incapacitate so many bowls as to make such economy unwise. The individual enameled iron lavatories are similarly piped, and an end elevation of the piping is given in Fig. 3.

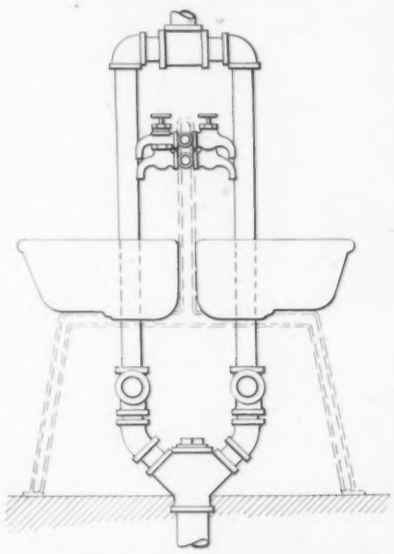


Fig. 3. End Elevation of Piping for a Battery of Lavatories

In buildings of the second class the lockers and washing facilities are usually combined in one room so as to make the fixtures as handy as possible. Under these circumstances an arrangement such as shown in Fig. 4 is used, and sinks of galvanized iron are generally substituted in place of the lavatories. In this room are shown two sides with 27 lockers each, or 54 lockers, a double middle row of 40, one row of 23 along the outside wall, two rows of 7 each along the inside wall, and 48 in the groups adjacent to the two sinks, making a total of 179.

Where sinks are used, 20 inches of side, not counting the ends, is considered the equivalent of one lavatory, so at the ratio of one lavatory to every 10 men there will be required 179/10 equals 18 lavatories, or 18 x 20 inches equals 30 lineal feet of sink. Each sink having two sides this means the overall length of sink equals 15 feet. This amount of lavatory space can be obtained in stock sizes, as two sinks each 6 feet long, or two each 8 feet long; but as the ratio of 1 to 10 is low, the two sinks 6 feet long would be enough.

These sinks are supplied through convenient faucets, but have only one waste and vent. They are installed with non-syphoning traps as shown in Fig. 5, wherever the local restrictions can be modified to permit such an arrangement. It is advantageous to adopt this arrangement if possible, as it obviates the carrying of a vent up to the ceiling at every fixture.

In the toilet rooms it is customary to arrange the fixtures together as closely as possible, water-closet stalls being seldom over 30 or 32 inches wide and 2 feet 6 inches deep, without doors. In the women's toilets, doors are, of course, often used and are even required by the factory laws in some states. In such a case the stalls are necessarily made 4 feet deep. Entrances to toilets in buildings where both sexes are employed should be carefully screened, and toilet rooms for different sexes should be separated by solid partitions of full height.

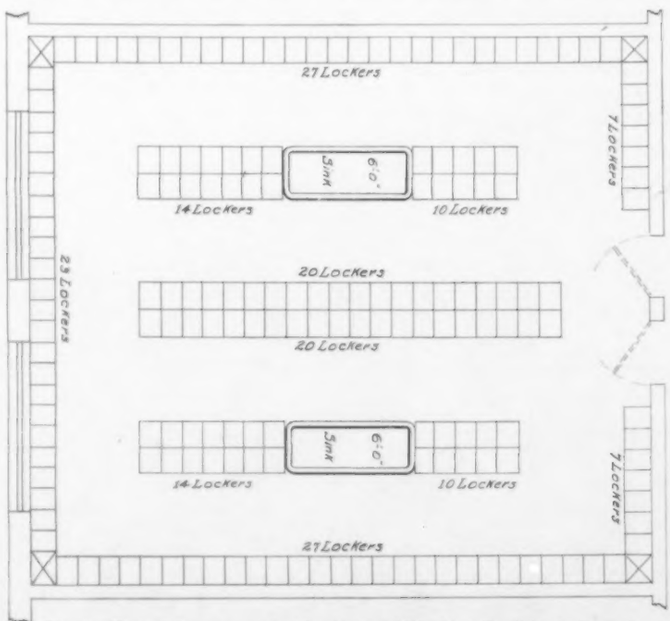


Fig. 4. Typical Arrangement of Lockers and Washing Facilities in Second Class Buildings

For the 187 employees whose locker and wash sinks are shown in Fig. 4 a toilet room somewhat as shown in Fig. 6 is suggested. The number of fixtures is obtained as follows:

187 divided by 20 equals 9 fixtures required.
9 divided by 3 equals 3 urinals.
9 minus 3 equals 6 water closets.

One lavatory and a slop sink are also usually placed in each toilet room. Were these employees female, a toilet room somewhat as indicated in Fig. 7 would make a good arrangement.

Water closets of the wash-down type either with or without the jet are much used, generally with a flush valve. The automatic compression tank closet makes a more ideal fixture, but it is more expensive. Both these closets are of such common type as to make a discussion of their characteristics unnecessary here. The low and high tank types of closet are little used, owing to their being subject to troubles from tampering. Water-closet ranges are in use in some of the steel mills and foundries where a large part of the force is formed by ignorant and careless foreigners on whom up-to-date accommodations would be, to a large extent, a waste of money.

The best type of urinal is undoubtedly the 18-inch stall fixture such as is shown in Fig. 8, this keeping the floor in a better and cleaner condition than any other style of fixture. The slate urinal of trough type with an inclined back and perforated flush pipe is also much used, although when all things are considered it is, if anything, more expensive than the fixture shown. Where slate urinals are installed on upper floors, lead safes have to be provided to prevent leakage troubles. The lip urinal is not satisfactory for industrial use and on a trough urinal 24 inches of length is considered equal to a single stall fixture.

The location of toilets should be determined to permit the employees' access to them without too long a walk involving loss of time from their work. In a long narrow building two toilets, one in the middle of each section, are preferable. The length of travel should not exceed 200 feet unless absolutely necessary. In shops where men only are employed much time is saved by installing urinal stations at various points in the shops and making the men travel to the toilet rooms only when water closets are required.

Similar principles apply to the location of drinking water fountains except that the length of travel should be kept down to as near 100 feet as possible. Because the fountains are often provided so frequently they come in locations, in many buildings, where soil and waste stacks are a great distance from them and even the sanitary sewer may be inaccessible. From this has developed the practice of running a drinking fountain waste stack with the bottom connected into the nearest leader line and the top carried through the roof. Into this stack the fountains on the various floors are trapped. The fountains themselves are most satisfactory when of the pedestal type with a heavy cast iron base and vitreous bowl and bubbler, similar to the one shown in Fig. 9. These can also be secured with a small ice tank in which a coil is placed, the water to the fountain coming through the coil.

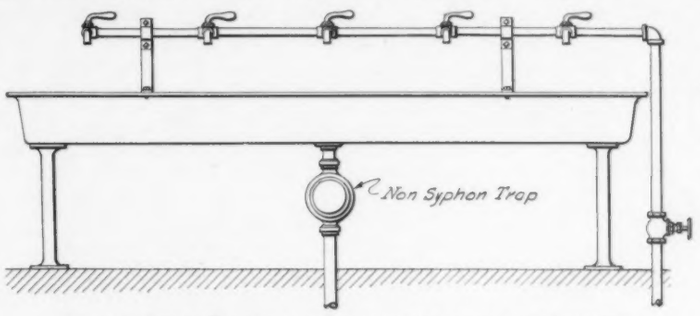


Fig. 5. Detail of Plumbing for Wash Sinks in Second Class Buildings

Shower baths are most economically constructed of slate, with a concrete trough lined with zinc, lead, or copper. The bathers stand on wooden gratings, and a slate step or curb is provided to form the front side of the trough.

Fig. 10 shows a six-stall shower of this construction and will offer a basis for modifications to suit the various conditions encountered. Generally speaking, showers should be provided where there is any process of manufacture involving either dust or high temperatures to which employees are exposed during their labors. The client, in the majority of cases, is familiar with the matter of whether showers are desirable or not.

Hot water for showers and lavatories is very desirable, there being no place where cleanliness is more needed than by persons spending eight to ten hours in the dust, dirt, and heat necessarily accompanying some of the industrial processes. In spite of this the hot water system is often installed only after considerable protest is made against its omission. Owing to the out-of-the-way and widely separated locations frequently selected for the various fixtures automatic gas heaters are becoming quite popular. With them long runs of steam pipe are avoided, the problem of returns is not encountered, and the heaters themselves require little attention. They do require flues, however, which must

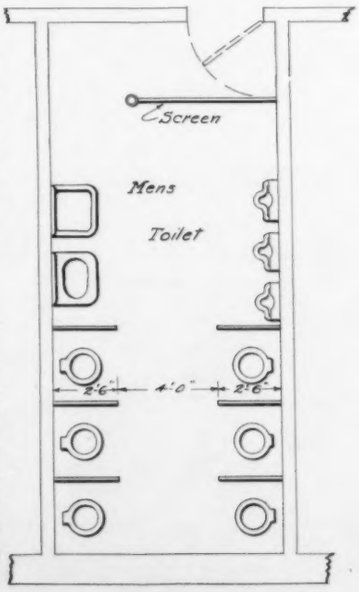


Fig. 6. Toilet Arrangement for 187 Male Employees

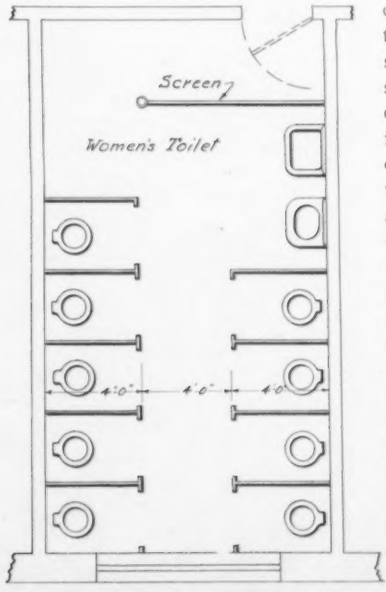


Fig. 7. Toilet Arrangement for 187 Female Employees

be carried up through the building and above the roof — an item of no small importance, especially in concrete structures.

The most common method of heating hot water is by an instantaneous steam hot water heater supplied with steam through a special reducing valve and not connected to the steam heating system in any way. The returns go to a trap — of the lift type if necessary — and can then be returned to the feed water heater. The reason for not connecting to the low pressure heating mains and using exhaust steam is that during the summer these lines will not be in operation and the hot water heater would be thrown out of commission.

In the larger buildings say of 500,000 square feet or over it is hardly practical to consider gas heating, unless natural gas is obtainable, owing to the expense of operation. Coal at $4.00 per ton (a high rate) will supply about 8,000 B. T. U. per pound for heating water at a cost of $.002 per pound, or 8,000 B. T. U., while even natural gas contains only about 1,000 B. T. U., of which not more than 90 per cent could be available, or 900 B. T. U. per cubic feet at .40 per M means $.0004 per cubic feet, or 900 B. T. U., which is just one-fifth the cost for one-ninth the heat. Transmission losses in the steam and return lines will reduce this probably to a point where the cost of gas heating will about equal that of coal.

It is the regular practice to run all pipes of every kind exposed, except the house drain, which is usually of cast iron soil pipe and buried under the lowest story. Owing to the fact of all piping being exposed, replacement at any time is comparatively easy and it is, therefore, not made of as permanent and lasting a character as would otherwise be the case. Black iron roof leaders are often used, brass pipe for hot water but seldom, and plain steel in the place of genuine wrought iron almost invariably.

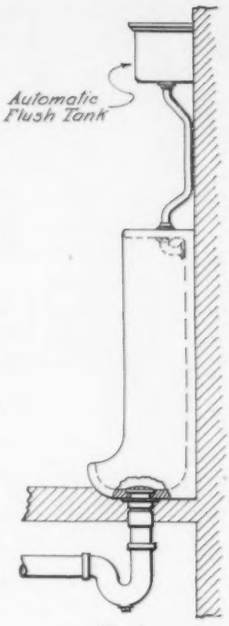


Fig. 8

Fig. 9

On the inside leaders conductor boxes are commonly omitted, the flat copper flashing extending out about twelve inches all around the top of the copper funnel to which it is soldered. This funnel tapers from two inches larger at the top than the nominal size of the leader pipe to the same diameter at the bottom; a neck piece about three inches long projects from the bottom of the funnel and is slipped into a common pipe coupling at the top of the leader pipe. Between the end of the neck and the top of the pipe a space of about one inch is left for expansion, settlement, etc., the neck sliding up and down inside of the leader coupling. The joint between the neck and the leader pipe must not be made tight, otherwise trouble is sure to result. The writer is personally familiar with a large factory of only one story height where the architect specified tight connections between the top of the leader and the copper funnel, and as a result of the contraction and expansion of the pipe, combined with settlement of the structure, every funnel was broken off at its point of connection to the flashing inside of three years from the date of completion of the building. If a tight connection must be used, a short piece of D-lead pipe just below the funnel will aid in absorbing some of the movement.

The above is indicative of the practical side of industrial sanitation and should serve as a suggestion from which a solid and economical installation can be intelligently developed.

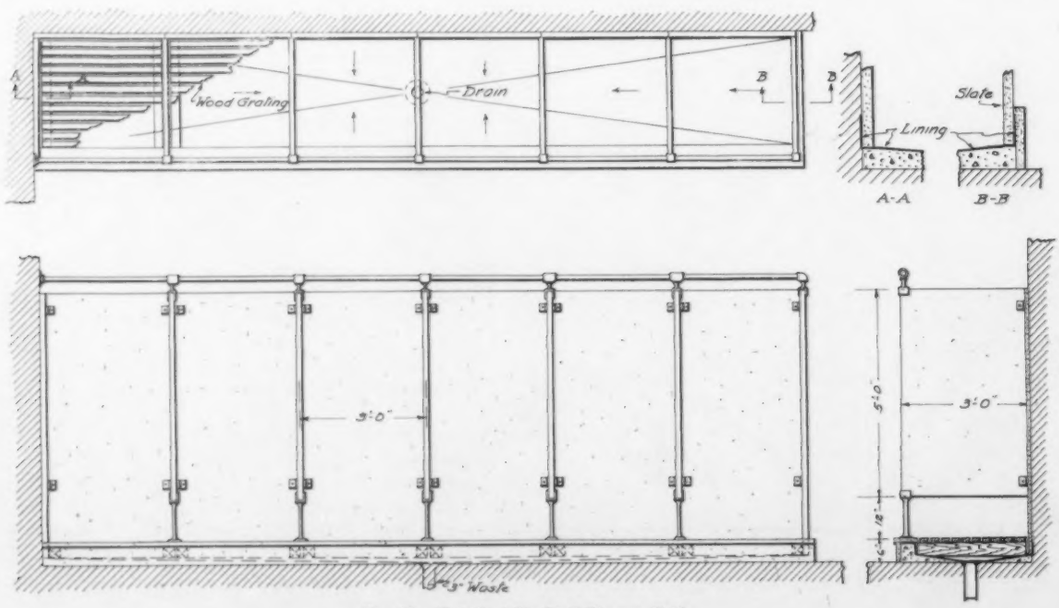


Fig. 10. Detail of Six Stall Shower Baths

PLATE DESCRIPTION.

PRINTING HOUSE OF R. R. DONNELLEY & SONS COMPANY, CHICAGO, ILL. PLATE 137. This building is planned to eventually cover an entire block and is so designed that it may be carried to an ultimate height of seven or eleven stories. It is of reinforced concrete construction with mushroom columns placed 24 feet 4 inches by 24 feet 10 inches on centers to permit the largest modern presses to be placed in the bays. The diameter of the columns in the lower stories is 39 inches and they are belled at the top to a diameter of 5 feet 9 inches. The story heights are 11 feet for the basement, 14½ feet for the first story, and 12½ feet for the remaining stories, the floor slabs being 11 inches thick, figured to carry a live load of 350 pounds to the square foot. Fire escapes are provided in brick towers at the corners of the building, cut off from all floors and entered through a communicating balcony.

FARMERS' TRUST COMPANY BUILDING, SOUTH BEND, IND. PLATES 138, 139. This building is designed for offices above the main story and for bank and store purposes on the street level. It is entirely of fireproof construction, the exterior piers being of masonry reinforced with steel, and the interior columns and girders of steel and concrete. The floors are of reinforced concrete and tile. The two end pavilions have no center columns and provide areas 34 feet wide by 84 feet long. The building has a capacity of 1,330,000 cubic feet and cost 21 cents per cubic foot.

HUMP HAIRPIN MANUFACTURING COMPANY BUILDING, CHICAGO, ILL. PLATE 140. This building is entirely of fireproof construction, the outside walls being of brick with a facing of medium gray rough textured brick. The floor and roof are of reinforced concrete construction. The floor spans are large, being 24 by 36 feet so that there would be least interference of columns with continuous lines of machinery. The building covers an area of 175 by 192 feet, and has a clear story height of 16 feet. In addition to side lighting it has sawtooth top lighting and is provided with a large amount of mechanical ventilation. The cost was about 12 cents per cubic foot.

REID, MURDOCH & CO. WAREHOUSE, CHICAGO, ILL. PLATE 141. This building is of reinforced concrete construction on a wood pile foundation, the floors designed to carry a load of 250 pounds per square foot. Structural steel was used for the tower roof construction and for the 40-foot span trusses in the second story over the railroad shipping court. The story heights are 9 feet 6 inches for the subbasement, 14 feet for the basement, 16 feet 8 inches for the first floor, and 12 feet for other floors. The total area of all floors is 443,300 square feet. The building cost, including dock and plumbing work 12 cents per cubic foot.

HAVANA AMERICAN COMPANY BUILDING, CHICAGO, ILL. PLATE 142. This building is used for the manufacturing of cigars and is of mill construction with brick walls. Supporting posts and girders spanning 15 foot 8 inches are of wood and the 5-inch splined flooring spans 14 feet. The special truss roof construction spans 28 feet and carries sawtooth skylights. The floors are designed to carry 150 pounds live load, and they have a total area of 103,000 square feet. The building is two stories high, 455 feet 10 inches long and 112 feet 5 inches wide. The first story height is 15 feet 10 inches, the second story 14 feet to the bottom chord of the skylight trusses. The total cost of the building, including mechanical equipment, was 7.9 cents per cubic foot.

LIQUID CARBONIC COMPANY PLANT, CHICAGO, ILL. PLATE 142. This group of buildings is used for the manufacture of soda water fountains. The main building consists of two 4-story wings, extending west and south from the corner tower, and a 1-story marble shop running west from the south wing. The tower is 28 feet square, the west wing 630 feet long by 80 feet wide, and the south wing 316 feet long by 80 feet wide. The marble shop is 144 feet wide by 399 feet long. The main portions of the plant are of reinforced concrete construction with brick exterior facing. The typical story height is 14 feet. The cost of the buildings without equipment was 7.5 cents per cubic foot.

KENT BUILDING, CHICAGO, ILL. PLATE 144. This building is occupied entirely by a clothing manufacturer. The general offices are located on the first floor, the power plant and shipping room in the basement, and the display room on the top floor, which is unusually high and lighted from the roof. Stairways and elevators are enclosed with fireproof partitions. Foundations are of concrete on piles and exterior walls are self-supporting above the fourth story. Interior columns are cast iron, carrying steel beams and girders and flat tile floor arches. The typical girder span is 17 feet to column centers and typical beam span 18 feet to girder centers. The building has a total capacity of 2,184,000 cubic feet and cost 17.4 cents per cubic foot, including a sprinkler system.

FACTORY BUILDING OF M. T. SILVER & CO. AND THE SUNSHINE CLOAK & SUIT CO., CLEVELAND, OHIO. PLATE 145. This building is used for the manufacture of clothing by two different firms, each occupying half of the building. It is constructed with brick exterior walls. Columns and floor slabs having a span of 20 feet are of reinforced concrete. Finished floors are of maple.

WAREHOUSE OF J. R. WATKINS MEDICAL COMPANY, WINONA, MINN. PLATE 146. This building is of reinforced concrete construction and is faced on the exterior with light gray pressed brick. The total height of the building is 120 feet, with a tower rising to 190 feet from the grade line. It contains two water tanks each having a capacity of 25,000 gallons. The floor spans are 17 feet 3 inches by 19 feet and the floor slabs are 10 inches thick, designed to carry 450 pounds live load throughout the building. All sash is steel, glazed with wire glass. The cost of the building was 15½ cents per cubic foot.

FACTORY BUILDING OF BLUMENTHAL BROTHERS, FRANKFORD, PHILADELPHIA, PA. PLATE 150. This building is used for the manufacture of chocolate and cocoa. The material is handled in a direct route from the top to the lower stories, and through the length of the structure to the shipping point. The building is of slow-burning construction with fireproof floors where safety requires. The exterior walls are of brick faced with a deep red brick with dark headers and trimmed with terra cotta. The story heights are 14 feet from floor to floor and supporting columns are spaced 20 feet on centers in each direction. Cost for construction alone was 5.8 cents per cubic foot.

EDITORIAL COMMENT AND NOTES FOR THE MONTH

THE ENGINEER AND THE ARCHITECT.

THE architect is always an engineer; but the engineer, even though he has charge of the construction of a building, is seldom an architect. The greater always includes the lesser. Both the engineer and the architect have had their share of the world's work. The great spectacular achievements such as railroads and canals have fallen to the engineer and his practice has crystallized into an exact science. Architecture, on the other hand, always has been an art. That is what makes architecture more than engineering and keeps it perennially alert and ready for changes — a condition which rarely exists in the engineering profession. It is but fair also to admit that because of the readiness with which the architectural profession welcomes new ideas, because of its constantly changing point of view, it is apt to lag behind in attention to the exact sciences and the so-called practical work. This has been strikingly manifested during the past generation. The architectural profession was offered the enormous possibility of steel construction. The æsthetic side of it was immediately appreciated and developed to an extent which has produced results of which we may well be proud; but the so-called engineering features were in a measure ignored, not because architects could not master them, but because the really architectural solution had first to be sought. The engineers speedily usurped one side of the architectural problem, and our earlier steel frame buildings were designed wholly by engineers, with the result, unfortunately, that sometimes the construction was made more of than the architecture, and efficiency of the hidden was substituted for complete efficiency of the whole. During the last few years the conditions have been changing and to-day it is fair to say that in most of the properly organized architectural offices the mechanical and so-called engineering problems in building construction are handled by the architect, and handled in a better, a more consistent, a more economical, and a more logical manner than the same problems were handled by the engineers in the earlier years. This is not saying that all architects are qualified to do their work. A profession is not judged by even its average attainment, but by its best work; and applying this measure to architecture it is fair to say that architects have outgrown any necessity of depending upon the engineers for construction.

On the other hand the engineers themselves have changed in their attitude toward architects. Structural engineering as a profession has not been very profitable of late years, and this fact has awakened many engineers to the possibilities of combining architecture with their own work. Since, unfortunately, the only requirement to be an architect is the ability to pay for a sign on the door, any one who can get a job can call himself an architect, and we have in many of our cities engineers who simply hire draftsmen, trust to their artistic luck, and get by with a good deal of building. In a few cases such engineers have developed real architectural talent, which the profession has been glad to recognize; but in more cases the result has meant a distinct lowering of architectural standards, and it is to be regretted that men who could be good engineers should choose to be poor architects for the sake of a little increased earning capacity. Most property owners would very naturally and very rightly prefer a good engineer to a poor architect, and as so many people fail to appreciate that architecture is not merely construction, heating and ventilating, plumbing and electric equipment, but is fundamentally an orderly, logical, and artistic solution of a practical problem, it is not to be wondered that the engineer-architect has thriven of late years; but this does not mean a limitation of architecture. Anything that makes for better building of any kind, practically or artistically, is welcomed by any right-minded architect; and if an engineer can do better work than an architect, it is up to the architect to mend his ways, though, as we said before, the thoroughly well equipped architect to-day needs very little help from the engineer.

The architect has learned his constructive lessons, and the relation now between the professions is that the engineers are learning to follow the architects' footsteps and striving to clothe engineering with a thin veneer of architecture. That, as far as it goes, is good. Anything which relieves the crass materialism and crude efficiency of an engineering structure is a benefit to the community, and we would hope that the relation between the two professions may continue to be one in which the architect will point the way to better, more orderly, and more logical building, without any sacrifice of the innate architectural properties, and the engineer will be more willing to appreciate that real efficiency does not stop with a well constructed skeleton; that no amount of good mechanics can atone for a bad design, and that good looks constitute a commercial asset.

BEAUX ARTS INSTITUTE OF DESIGN.

IT IS under this title, and incorporated under the Board of Regents of the State of New York as a school to teach design in Architecture and also Sculpture and Mural Painting in their relation to Architecture, that the educational work hitherto conducted by the Society of Beaux Arts Architects will henceforth be known, this society having voluntarily surrendered the educational privileges of its own charter so that a new institution, controlled, however, by the same principles and persons as the former, might extend itself into fields broader than those of a purely architectural association. Circulars of information for courses may be obtained by writing to the Beaux Arts Institute of Design, No. 126 East 75th street.